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FURTHER REPORT ON SYNERGISTIC ANALGESIA AS EMPLOYED IN CASES ABOUT THE HEAD AND NECK.*

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Wonderful progress has been made in the last decade in the realm of anesthesia but we are still confronted with problems of the best type of anesthetic agent to use in each individual case. Rules can hardly be formulated to cover the entire field of surgery, as to what form of anesthesia to use, but after having worked up what seems to be a fair number of cases in our series we feel prepared to report again our experience with synergistic analgesia. From the work of the last few years, we have come to the conclusion that we can recommend to our colleagues a technique of great merit and although this report does not add a great deal to our original detailed work on this subject, we feel duty-bound to again bring it to fore, and especially since it was originally published in a non-oto-laryngological journal.

It is now a matter of over four years since we became interested in the use of synergistic analgesia as popularized by James T. Gwathmey, of New York City. Previous to this time the various forms of anesthetics were employed by us, such as ether, chloroform, ethyl

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chlorid, nitrous oxid in its various combinations, intraspinal, morphin-scopolamin, as well as those for topical and hypodermic use. One of us (J. C. B.) some years ago, in a small series of cases, had given rectal anesthesia according to Gwathmey, without the morphin-magnesium sulphate combination, and had reported before the Chicago Laryngological Society, in 1915, certain objections, which consisted mainly in that the anesthesia was in most instances too profound and of too long a duration.

General Considerations: It is not the purpose of this paper to historically analyze the various types of anesthetics, nor to show the advantages and disadvantages of the various forms, but to stress the value of synergistic analgesia as one of the successful and useful types of anesthesia, particularly as it pertains to our special field. In our practice, this form of analgesia is rapidly becoming the most popular and one of the most practical forms of administering an anesthetic. Admittedly, it is an easy method, and although we would not be so dogmatic as to say that it is not in the least fraught with danger, we maintain that it has served us well and we no longer set a limit as to the number of cases we desire in our series.

Synergistic analgesia has been described by some authors as being a very simple mode of administration, and yet it has many intricacies into which the unwary may blunder. Naturally, we did not go into the study of such an anesthetic blindly, nor did we throw into the discard the other forms of local and general anesthesia which have to this day served us well. Therefore, while we were aware of the excellent results claimed for this anesthetic and knowing that it was not a task for the tyro or inexperienced anesthetist, we cautiously proceeded with its use.

Present-day researches in the realm of anesthesia have in the main a trend to find a more satisfactory method for inducing and maintaining analgesia and anesthesia. We would not, however, have it appear that our investigations with synergistic analgesia are evidence to the observer that such methods as local, general or any other forms are not satisfactory, but, on the contrary, our work was only to prove the efficacy of another useful method added to our armamentarium and to the art of anesthesia.

To us, synergistic analgesia came as a solution to many problems which had, heretofore, been overcome only by putting up with many difficulties or solving them in not the most convenient manner. In the majority of operative procedures about the head and neck, many difficulties present themselves, particularly due to the fact that the already small field has too many hands around it for the comfort of the patient and the convenience of the operator. In surgery of the

face and jaw it is of the utmost importance that the anesthetist's manipulations should not transgress the rigidly asceptic field which, for example, all plastic work demands. One might enumerate the many types of operative procedures where the danger of sepsis is increased by the presence of the anesthetist's hands even under the most favorable conditions, and where strict asepsis is attempted. We have nothing to say against the use of local infiltration in minor plastic procedures, but find the rectal-intramuscular method of value in other ways.

We find that in our special field entailing work about the respiratory tract (head, neck and chest), especially such as lying open the mouth, larynx, pharynx, esophagus, trachea and bronchi, there is a distinct advantage in this type of analgesia. Moreover, the synergistic type of analgesia is well employed in operative cases wherein the patient is suffering from respiratory embarrassment or in whom the amount of absorption must of necessity be limited, because of lung, heart or kidney lesions.

Local Anesthesia: Local anesthesia is the method of choice of practically all American rhinologists, perhaps on account of the simplicity of its administration and its possibly greater "safety". The latter term is perhaps a rather broad one to use with reference to any form of anesthesia unless its use is placed in the hands of the experienced. There can be no doubt that anesthesia, properly conducted, is distinctly a science, and is as intricate a part of the broad field of medicine as much as any other specialty. Therefore, we would say that the mortality rates are not always an indication of the toxic or harmful effects of the agent used; but in many instances are due to the lack of a thorough understanding of internal medicine, with special reference to the individual patient, and the lack of a fundamental education regarding the choice of anesthetics suitable to particular cases, and the only can we greatly increase our coefficient of safety. However, since fatalities do occur with undiminished regularity even in the hands of skilled anesthetists, the general condition of the patient has become an important factor in determining the risk of operative procedure.

Only recently have we been somewhat restricted even in the use of local anesthetics by the report of the committee of the American Medical Association for the study of toxic effects of local anesthetics. Their study of the deaths supposedly due to local anesthetics, led them to recommend that cocain should not be injected into the submucous tissue or subcutaneously and that cocain paste ("mud") should not be used as a preoperative measure; in fact, its use in the latter way was unreservedly condemned. However, they believed

that cocain could be applied safely in the following concentrations and total amounts: "Cocain in the mouth and epipharynx (preoperative), 5 per cent; in the nose, not over 10 per cent, and in total amounts of from 10 to 15 minims, containing from 1 to 1.5 grs.; in the eye, not over 5 per cent; in the larynx and bronchi, not over 20 per cent—preferably 10 per cent in two applications—and not over 15 minims total, containing from 1 to 1.5 grs. Procain should not be used in greater concentration than 1 per cent; apothesin, not greater than 2 per cent. Not more than 1.5 grains of apothesin should be injected for one patient. The use of butyn by injection appears inadvisable because of its relatively high toxicity; if injected at all, the concentration should not exceed 1 per cent nor the total dosage 1 gr. Butyn may be applied topically in a 2 per cent solution. Epinephrin serves a valuable purpose in causing a bloodless field and in delaying the absorption of the local anesthetics, especially procain, but the addition of epinephrin in amounts of 1 mg. or more to a solution of cocain often results in a greater degree of toxicity than from cocain alone, when rapid absorption takes place; hence, the use of larger doses of epinephrin with cocain is deemed unsafe, and epinephrin should not be used in greater concentration than 1:10,000 and of this not more than 10 minims with cocain. Somewhat larger total amounts of epinephrin may be used with solutions of procain, but not more than 1 mg. of epinephrin should be used, and even this dose may be unsafe in patients suffering with hyperthyroidism.

We have for the past four years advocated the use of cocain paste in our operative work on the nose, accessory sinuses, and throat and have not experienced one untoward effect. One of us (J. C. B.) shortly after Otto Freer reported on the merits of cocain paste some twelve years ago, went on record as being opposed to its use because of a collapse in a thirteen-year-old boy following the use of the paste for a submucous resection. However, it was pointed out that cocain and the age of the patient were not as safe as, it would seem, from those reported in the series by Dr. Freer. Since restoring the use of the paste again until stopped by the action of our colleagues, we had always adhered to the principles as outlined above. The paste was always topically applied and in limit doses, but never did we supplement it with any submucous or subcutaneous injection of any other anesthetic agent. In the majority of deaths investigated by the above mentioned committee, it will be noted that in practically every instance adjuncts were used in hypodermic form. In fact, three years ago we discontinued the use of adrenalin with the cocain, feeling that the concentrated solutions and mixtures of

the cocain were astringent enough to prevent anything but local action. The work of Ross and his co-workers proved definitely that the toxic effects of cocain were enhanced by adrenalin in combination with it. Then, too, we have not allowed cocain in any strength to be used hypodermically nor do we permit even the presence of the same in our operating room for fear of a mishap as a mistaken drug.

In regard to the weaker concentrations of cocain, such as a 5 per cent solution, we have used it almost routinely in office practice for treatment purposes and seldom have seen enough anesthetic action to attempt even as much manipulation as an antrum puncture. For operative work such a weak solution has not proved successful in our hands. However, with 20 per cent solutions, we have been able, in a measure, to carry on our operative work.

We are by no means of the opinion that local anesthetics must therefore be discontinued, but on the other hand, we are striving to find a more suitable type or method for the same. Only recently, from the work of C. Hirsch, of Stuttgart, we were given impetus to work with a new preparation which he calls "Tutocain", a hydrochloric salt of an amino-benzoyl-dimethylamino-methyl-butanol group. Hirsch claims for this product that it does not decompose by heat; can be used hypodermatically as well as topically; a higher threshold of anesthesia than any other agent; and contrary to cocain, non-poisonous. If this proves true, the question of local anesthetics would, at least to use, not appear so troublesome. However, we have it from authoritative information that this product is not obtainable in this country, so it remains for American investigators and chemists to produce an analogous product.

The point, which we would like to make in this connection, is not to take issue with the committee's report, for we wish in every way to co-operate with them until they, perhaps, will see the light, but we wish to emphasize the important position that the method of synergistic analgesia takes in our minds in relation to the situation we find ourselves in. In other words, it takes the place of the local method. In our first report we brought out the point that we did not intend this method to take the place of local anesthetics, but used it in many minor procedures, at first, to test its value. But we are now convinced of its value even as a substitute for local anesthetics should the situation not take on a brighter outlook.

Controlling Shock: If ever an ideal anesthetic presented itself, we have found it in synergistic analgesia. We all recognize psychic domination as a valuable adjunct in anesthesia. To impart to a patient, an enlivening sense of security, to allay, to some extent, the

phobias and delusions which are so imbued in his mind, is not the simplest task for the physician. The terror of the operating room of glaring white, the almost death-like tranquility and the observation of all things connected with the operation, are naturally not conducive to a restful mood. To anyone who has watched an operation under local anesthetic, with its stimulation of the cerebration, and its resultant loquacity and anxiety; or anyone who has witnessed anesthesia by the inhalation method with the wait for its induction and accompanied by the usual excitement stage, synergistic analgesia presents a pleasant surprise. The almost uncanny child-like slumber under the most trying circumstances in formidable operative procedures has been the source of many conjectures. To do a laryngectomy, considerable time is required and to have the patient at all times co-operative and responsive throughout this very major procedure, is to have an experience that thrills the onlooker almost as much as seeing the much "sawed-up" woman cut in two.

The important phase of the practice of anesthesia, which is constantly brought to bear, is the question of shock. To George W. Crile we owe much of what we know of the combined use of local analgesia with general anesthetics. Gwathmey states that by employing synergistic methods, a complete block against pain impulses, including the cutaneous nerves, is obtained and that, therefore, Crile's *anocithesia* may be considered obsolescent. We cannot fully agree with this, particularly with regard to the cutaneous sensitiveness, but we would venture a statement that synergistic analgesia is as near an approach to the anocithesia method as one can get with any other agent. All of us have had the experience of seeing the disastrous effect of terror and anxiety natural to the patient who contemplates a surgical operation on himself, even after all the effects of actual trauma are obviated.

A synergized patient receives his induction of analgesia gradually, amid the pleasant surroundings of his own room and Crile's important observations as regard to shock are in a measure strictly adhered to. Thus psychic shock is prevented by such a preparation. This principle is one that is not a great deal different from Crile's preparation in extreme, emotional thyroid cases, in which the patient is occasionally anesthetized in his own room, supposedly for therapeutic purposes, until he is finally prepared for operation.

Prof. Yandell Henderson, of Yale, is a research worker who has added much to our knowledge of surgical shock. He has advanced what is known as the acapnial theory of shock, in which he cites the lack of carbon dioxid, not only as inducing apnea, that is, cessation of activity of the respiratory center, but also in reducing other im-

portant functions so that the heart beats more quickly and the blood pressure falls. He, therefore, suggests that acapnia is the primary cause of shock. In synergistic analgesia acapnia is not a factor due to carbon dioxid over-ventilation for the blood is always fully oxygenated and consequently cyanosis has never been observed by us.

Then, too, synergistic methods are of great value to the busy surgeon who is pressed for time. To keep a patient waiting for an operation is almost torture, but delay is a negligible factor when patients are synergized. In fact, changes in our methods of procedure were made by accidentally noticing that those patients who were delayed and not brought in as per schedule were better prepared surgically than any of those who were brought to the operating room almost immediately after they had received their rectal ether-oil. Neither is there any need for haste on the part of the surgeon for fear of jeopardizing the patient's life, as the patient does not lose reserve vitality because of a lengthy procedure—under synergistic analgesia.

The Problem of Technic: While much has been contributed to the literature of synergistic analgesia during the last year or two, there does not seem to be any definite idea as to what is really meant by the term as regards a definite technic to be followed. One is led to believe that this is due to the gradual evolution of Gwathmey's work in this field. Some report cases of synergistic analgesia as giving only magnesium sulphate and morphin for preoperative preparation, while others use the rectal combination alone. In fact, we have observed and so have others, that the injections of morphin and magnesium sulphate, alone, are often sufficient to produce perfect analgesia, but this has not proved as constant in obtaining uniform results as has our present technic. Anesthetic efficiency has been obtained, however, in some cases even with the ether thus eliminated.

When Meltzer first experimented with the anesthetic properties of magnesium sulphate, he used it alone and administered it intravenously. It has no deleterious effect on any of the tissues or organs of the body. When used with morphin, it does not seem to have any toxic effect upon the respiratory center and seems to hold the morphin in contact with the tissues for a longer period and thus enhances its analgesic action. Magnesium sulphate has been known to affect the respiratory center, although we have not experienced this complication. However, if respiration does become embarrassed, some authors use calcium chlorid intravenously, while Gwathmey advises the uses of large amounts of normal salts intravenously,

and, on the basis of restimulation of the respiratory center, the rebreathing of the patient's own expired air.

In the consideration of the technic of synergistic analgesia, we are concerned with certain fundamentals in its administration. The dosage is guided mainly by the age, weight, general condition and mental makeup of the patient. However, the average dose for every fifty pounds of body weight is ⅛ gr. morphin sulphate combined with 2 c.c. of a fresh, sterile, C. P. magnesium sulphate solution (50 per cent), and 2.5 per cent novocain; equal parts of olive oil and ether (each 1 oz.), and 1 dr. of paraldehyde (U. S. P.). For the average individual weighing from 135 to 150 pounds, three doses are usually required. The morphin-magnesium sulphate combination is given intramuscularly, deep into the gluteal region or subcutaneously at one-half hour intervals between each injection. Then, one-half hour following the last hypodermic injection, the rectal administration is begun. Because of the discomfort that results from introducing fluids into the rectum, this part of the procedure should be done slowly and in small amounts, taking about twenty minutes to introduce the entire quantity.

It is a fallacy to assume that the entire amount given is immediately absorbed. As a matter of act, Gwathmey has estimated that about 2 ounces of ether are absorbed in an hour; and since each molecule of ether is combined with one of the oil, and only by evaporization is this combination broken, absorption must be slow. This point is significant for two reasons: *1*, because there results a steady, never deep, and constant anesthesia as vaporization occurs, regardless of the percentage of the mixture used; and *2*, that should it be deemed necessary, the bowel may be flushed with cold water and much of the ether recovered. The latter safeguard has been confirmed by flushing the bowel even four to five hours after the introduction of the ether. This possibility accounts for the perfect surgical analgesia persisting hours after the administration of the rectal combination.

Notwithstanding the slow absorption of the rectal mixture, it seems to be quickly eliminated, as the paraldehyde odor, particularly has been observed on the breath of the patient from four to six minutes after its introduction into the rectum. However, the patient inhales warm, moist air at all times so that when the ether is absorbed into the small blood vessels and carried through the liver and on to the heart, it can be easily eliminated by the lungs. At no time, in our series, has any irritation either to the gastro-intestinal tract or respiratory tract ever been noted. The patient's color remains good and the body temperature normal.

The necessity of a unit of measurement in anesthesia is self-evident and there is no doubt that any scheme not based on measurement of dosage is unscientific, crude and dangerous. However, there are certain other factors which influence this form of anesthesia, which in our experience must be considered in relation to dosage. For example, we have noted that in high strung, nervous individuals there seems to be such a tolerance for the drugs that an extra dose is often indicated. Also it has often been brought to our notice that nothing should be introduced into the rectum that cannot be reclaimed, but our experience with synergistic analgesia can be our only guide, and our knowledge of the fact that the rectal combination can be flushed out, if necessary, has given us confidence to carry on. This latter objection has so frequently been raised by our colleagues that from the above statements, they should be convinced that their viewpoint is wrong.

Summary of Technic and Dosage: For the average individual weighing from 135 to 150 pounds, the method of synergistic analgesia is as follows:

1. Prepare patient as for general anesthesia on the evening prior to operation, *i. e.*, enema and cleaning of operative field; the enema should be repeated on morning of operation. Give nothing by mouth after midnight.

2. Three to four hours prior to the time of operation administer intramuscularly deep into the gluteal region or subcutaneously, morphine sulphate grs. ⅛, dissolved in 2 c.c. of a sterile, fresh 50 per cent solution of magnesium sulphate (ampules preferred) together with 2.5 per cent novocain.

3. Great care should be taken in thoroughly cleansing the site of injection with benzin, iodin and alcohol and equal care should be given to the needle and syringe, which should be absolutely sterile.

4. These injections are repeated at half-hour intervals until three doses have been given.

5. A half hour after the last intramuscular injection has been given, administer slowly per rectum (over a twenty minute period) a solution of the following: ether, 3 oz.; olive oil, 3 oz.; paraldehyde, 2 dr.

6. Proper environment is then supplied by dimming the lights and by guarding against disturbance of the patient.

7. Transport the patient to the operating room with the least amount of disturbance possible.

We cannot agree with Gwathmey that this method does away with the necessity of the supervision of an expert anesthetist; in fact, we would encourage the employment of a professional anesthetist who

has a thorough knowledge of synergistic analgesia. Our student nurses have been taught the method of administration, but always under the supervision of a trained anesthetist. They are also instructed in watching for symptoms which would indicate an idiosyncrasy for any of the drugs and overdosage. The injections are given at such intervals that one can readily observe any untoward symptoms, should they occur.

We have not found occasion for interrupting our anesthesia in any of our cases, although we are constantly on the lookout for complications should they develop. To insure further safety as to dosage and to avoid any possible error in technic, it occurred to us that the morphin and magnesium sulphate, being a standard dose, could be put up in ampule form. One of us (F. L. L.), in personal communication with Dr. Charles Hooper, of the Metz Laboratories, has found them to be quite in accord with our views along these lines. They have been experimenting with magnesium sulphate put up in ampule form since 1921 and have prepared sterile, stable, solutions of magnesium sulphate and morphin and magnesium sulphate. These solutions have been tested out for their sterility and stability and while some of the ampules are now over a year old, the solutions are still water clear and have retained their full analgesic potency. They have been employed for all the purposes for which morphin would be employed in the hospital and results have been very satisfactory. Moreover, they have not given rise to painful tissue reactions at the site of the injection. This work in the Metz & Company laboratories has been carried out by Dr. Charles A. Hooper, who has been associating himself with Dr. Gwathmey in this synergistic research work.

Recently Drs. Hooper and Gwathmey gave a demonstration in New York City before the Regional Society of Associated Anesthetists of the United States and Canada (Oct. 22, 1924). Their laboratory demonstrations were to show the following:

1. The synergistic action of magnesium sulphate, novocain, morphin and ether.

2. Comparison of the effect of morphin and magnesium sulphate, morphin and novocain when administered intramuscularly.

3. The inhibitory effect of magnesium sulphate and novocain on the development of morphin tolerance.

The first two points were shown in albino rats and the third was demonstrated on dogs and cats. "In quantitative experiments with albino rats, it has been found that the intravenous administration of less than one-half the anesthetic dose of magnesium sulphate combined with approximately one-tenth the anesthetic dose of ether produces surgical anesthesia without increasing the toxicity of the com-

bination. The addition of 2.5 per cent novocain and 0.4 per cent morphin to a 50 per cent magnesium sulphate solution enhances the analgesic and anesthetic action of the magnesium sulphate at least 50 per cent when injected subcutaneously in albino rats. A gas chamber has been arranged in order to compare the synergistic action of magnesium sulphate and ether with magnesium sulphate, novocain, morphin and ether."

The ampules containg the combined magnesium sulphate-morphin-novocain solution have now been marketed and come under the Harrison Narcoti Law. In a 2 c.c. ampule, there is contained 50 per cent magnesium sulphate, C. P. (1 gm.), 2.5 per cent novocain (0.050 gm.) with ⅛ gr. of morphin (0.0081 gm.). The addition of the 2.5 per cent novocain to the combination is said by these workers to increase the analgesic potency of the solution approximately 25 per cent, and we are now employing these ampules, thus safeguarding and simplifying the technic.

The subcutaneous or intramuscular injections of a fatal or nearly fatal dose of morphin in the cat (20 mg. per kilo) has an exciting effect. The animal races about as if in extreme terror, with prominent eyes and widely dilated pupils, scratching and clawing wildly. Sometimes there are even convulsions. In all of the experiments that Meltzer and his collaborators carried out with the injection of magnesium sulphate, not a single instance was observed in which this salt produced an increase of excitation; on the contrary, any effect which it produced was invariably in the direction of a reduction of excitation or of its complete temporary or permanent abolition. With these facts in mind eight cats were injected intramuscularly, three with morphin alone (20 mg. per kilo) and five with the morphin dissolved in 50 per cent magnesium sulphate solution with 2.5 per cent novocain (800-1200 mg. $MgSo_4$ per kilo). The three control cats developed a violent mania. The animals that received the morphin dissolved in magnesium sulphate and novocain did not become violent and four of the animals soon became deeply anesthetized. The experiments show that magnesium sulphate is capable of reducing or completely inhibiting the symptoms of excitation which follow the injection of morphin alone in the cat.

The work of Gwathmey and Hooper can be summarized as follows: The synergistic action of magnesium sulphate and ether is described on a quantitative basis. Magnesium sulphate and ether act synergiestically in producing anesthesia when injected in combination into the saphenous vein of the albino rat as a water solution containing 6 per cent ether and 6 per cent magnesium sulphate. The synergism is of the potentiated type. The toxicity of magnesium

sulphate and ether is additive when injected in combination into the saphenous vein of the albino rat as a water solution containing 6 per cent ether and 6 per cent magnesium sulphate. The toxicity is a simple summation of the toxicities of the two compounds. The anesthetic dose of magnesium sulphate approaches the fatal dose very closely when injected into the saphenous vein of the albino rat as a 6 per cent water solution or when injected subcutaneously as a 50 per cent water solution. The margin of safety is slight. The anesthetic dose of ether represents approximately 40 per cent of the minimal lethal dose when injected into the saphenous vein of the albino rat as a 6 per cent water solution. The anesthetic dose of magnesium sulphate and ether represents approximately 50 per cent of the minimal lethal dose when injected as a water solution containing 6 per cent magnesium sulphate and 6 per cent ether. Concentrated magnesium sulphate solutions have little or no germicidal action. Contaminated solutions are not readily sterilized by boiling. Sterile 25 or 50 per cent water solutions of specially tested, chemically pure magnesium sulphate do not produce abscesses or severe tissue reactions when injected with asepsis subcutaneously or intramuscularly into the albino rat or the human being (2 c.c. injected at one site). The addition of 2.5 per cent novocain to a 50 per cent magnesium sulphate solution with morphin sulphate 0.4 per cent (2 c.c. contains ⅛ gr. morphin) increases the analgesic and anesthetic actions of the combination at least 25 per cent and also definitely prolongs the effect when injected subcutaneously or intravenously into the albino rat. In a limited number of experiments with dogs, the subcutaneous or intramuscular administration of morphin dissolped in 50 per cent magnesium sulphate solution with 2.5 per cent novocain (⅛ gr. morphine in 2 c.c.) has not been followed by salivation, vomiting or defecation. The simultaneous administration of magnesium sulphate 50 per cent solution with 2.5 per cent novocain (800-1200 mg. magnesium sulphate per kilo) reduces or completely inhibits the symptoms of excitation which follow the subcutaneous injection of a fatal or nearly fatal dose of morphin in the cat. Based on animal experiments the clinical dose of 2 c.c. 50 per cent magnesium sulphate solution administered subcutaneously or intramuscularly is at least 100 times removed from the fatal dose. Magnesium sulphate used alone in sufficient amount to produce anesthesia is the most dangerous anesthetic known. When used as a synergist with other drugs it may become one of the most valuable drugs in the pharmacopeia.

The Analgesic Operative State: The analgesic operative state may be compared to some of the forms of alcoholic intoxication, for

we have observed in different individuals various forms of "jaggs". These states were mainly those of hilarity and depression with intermediate forms of various gradations. The majority of patients were responsive to questioning and even volunteered sensible remarks themselves. If they were asleep they could be easily aroused and responded in accordance with the type of "jagg" they had.

Patients are brought to the operating room with the least manipulation possible and a suitable quiet environment is maintained. In our field we cannot particularly agree with what Keene says—"the ideal anesthetic is not one which will abolish pain without abolishing consciousness"—for in our opinion the anesthetic to be sought is that which permits the patient to co-operate and yet remain insensitive to pain. When the patient is quietly placed upon the cart and is brought to the operating room, he arrives there either quiet or sleeping; he is not apprehensive nor does any talk of his operation place him in an uncertain frame of mind.

In about 9 per cent of our cases the lifting of the patient has produced some nausea, but in very few instances has it occurred before the patient was brought to the operating room. In the latter cases we felt that the nausea followed the administration of the morphin. The explanation advanced for the very little nausea produced is that the magnesium sulphate prevents the late effect of morphin, among which is the possibility of nausea. There is certainly an advantage in the use of magnesium sulphate in combination with morphin, because it enhances the value of morphin from 50 to 100 per cent without getting the toxic effect of that much of the drug. For the latter contribution we are greatly indebted to Meltzer, Gwathmey, and the staff of the Presbyterian Hospital of New York City.

Accessory Anesthesia: In some of our cases accessory anesthesia had to be resorted to, particularly in cases where skin and, at times, mucous membrane and periosteum has to be incised. But it was noted, and quite strikingly so, that when accessory ether or infiltration was resorted to, it took but comparatively small amounts. Such insufficient narcosis occurred in about 14 per cent of our cases; and then by the addition of a little inhaled ether, or the injection of the skin or periosteum with 2 per cent apothesin, enabled the surgeon to complete the operation without a halt. It has also been noted that patients who were decidedly poor subjects for ether by the inhalation method because of alcoholism, etc., responded very well to synergistic analgesia, and even if accessory anesthesia had to be given, it took very small amounts to have the patient completely anesthetized.

Of patients asked, the day following the operation, what had transpired in the operating room, the majority answer that they remember nothing or else had a vague idea of what occurred. We have had patients who answered questions intelligently, and yet after the operation remembered nothing of what was said. Also in certain cases, when pain was seemingly complained of, patients stated later that they had no recollection of having suffered any distress. We would advise against the policy of trying to convince a patient that he has no pain when he complains of such, as we much prefer to supplement the analgesia with small amounts of local infiltration or ether vapor.

When the patients are returned to their rooms, after the completion of the operation, they are usually in quite a restful mood. Some individuals, who have exhibited a tendency toward the hilarious type of "jagg", occasionally continue to be quite talkative. To us, the postoperative analgesic state appears as a distinct advantage. Usually the patient, who has been operated on in the morning, remains more or less drowsy until late evening, and then is sufficiently quiet to go through the night without the need of an analgesia. There is no epigastric distress whatsoever, and in less than 0.5 per cent of our cases have we had to administer an added analgesic. If a postoperative analgesic had to be given, it was in small dosage and this had a more lasting effect than is usually noted. However, such an added analgesic was usually not required before midnight, as the operative analgesia was usually sufficient until that time.

Complications: There have been some instances when our patients were too deeply narcotized; that is, they did not respond as readily as they usually do. However, our coworkers have been instructed to stop all further medication in any instance where a patient goes to sleep before the entire amount has been given. In cases where the patients were found too deeply narcotized, they were returned to their rooms and left there until they had sufficiently recovered from their anesthetic to warrant our going on with the operation. In several instances the bowel was flushed out and the greater part of the rectal combination recovered. The symptoms never became especially alarming, but we always considered it a matter of safety and surgical precaution not to operate on an individual who was over-anesthetized.

Only in one case did we have what might be called a serious condition, and in this case the complication could not be directly attributed to the anesthetic. The incident occurred in operating on a young Italian, age 28 years, who came to us complaining of anosmia and stuffiness of the nose. Examination revealed both sides of the

nose filled with polypi and the X-ray showed a marked ethmoid involvement. The patient was brought to the operating room at 11 a. m. At the time of operation it was noted that the entire ethmoid labyrinth was soft and even the lamina papyracea was involved in the pathological process. The patient bled very freely after the complete exenteration of the ethmoids. Packing, which is not usually practiced in our clinic in this type of operation, had to be done and apparently all hemorrhage had ceased. Two hours later the nurse called our attention to the fact that the patient was bleeding quite profusely and, no doubt, had probably been bleeding since his return from the operating room, for upon examination we found much blood coming down postnasally. Physical examination of the lungs showed them to be partially filled, due to aspiration of the blood. Toward late afternoon bleeding became more profuse and could only be controlled by rather heroic measures. The patient passed away early the next morning, practically exanguinated, without having regained consciousness.

In this entire series, this case was the only one which showed a tendency to bleed, all the other cases evidencing less tendency to bleed than with general anesthesia. In reference to bleeding, it is important to note that a patient under synergistic analgesia is not so unconscious as to have his reflexes abolished, so that should blood trickle down into the pharynx or larynx, the patient will either expectorate it or will retain it until he remonstrates or else until the operator commands him to clear his throat. This is in favor of the synergistic analgesia operative state, and as far as the much talked of lung abscess complication of nose and throat surgery is concerned, this complication is either minimized, or the chances of its occurrence are almost nil. However, insofar as our statistics are concerned with lung abscess following head and neck operations under general anesthesia, the control of aspiration would not be the greatest advantage of this method, for in our experience we have had but one lung abscess case which complicated a sarcoma of the antrum.

There have been some cases in which an indurated painful area appeared at the site of injection and these have given us our only really marked difficulty. This complication occurred in seven cases in our series before we had the drugs in ampule form. These areas usually develop about the fifth or sixth day and while only comparatively few in number, they have given us some concern. They may be due to several factors: *1*, poor technic as to cleansing of parts and the sterilizing of the instruments; *2*, striking a vessel followed by the formation of a hematoma and the breaking down of same; *3*, the

possibility of the magnesium sulphate causing the induration when injected too superficially.

Types of Operations: To list in detail the cases undertaken in this series would be cumbersome and not particularly valuable for study, and so the data given herewith mainly concerns the types of operations in the series and certain conclusions arrived at. They are as follows:

Tonsils	278	Sinus (radical)	171
Mastoid	372	Frontal	39
Simple	229	Antrum	78
Radical	136	Ethmoid and Sphenoid	55
Sinus Thrombosis	7		
Larynx	160	Rhinoplasty	264
Laryngofissure	32	Otoplasty	111
Laryngectomy	12	Facial plastics	153
Laryngoscopy	54	Eye	39
Intralaryngeal	62	Nerves	42
Septums	108	Jaw	27
Intranasal	127	Brain	18
		Thyroids	22
		Miscellaneous	212

Other Details: The patients ranged from 5 to 74 years of age. The analgesia was employed in cases ranging from a marked thyrotoxicosis to known heart lesions and marked emaciations due to malignancy.

In those cases of bronchitis and asthma, in which general anesthesia was contra-indicated, synergistic analgesia was employed without any untoward effects.

Insufficient narcosis occurred in about 14 per cent of our cases and then by the addition of a small amount of accessory anesthesia, either by local infiltration or by drop ether, the necessary analgesia was induced. Suggestive methods are not encouraged for inducing sleep.

Nausea and vomiting occurred in about 9 per cent of the cases and usually not until the patient was being moved about.

No patient complained of any form of gastric distress such as often follows general anesthesia. Gas eructation was present in about 7 per cent of the cases.

In this series there were no kidney or bladder disturbances and urines were carefully checked at various intervals without pathological findings.

Acidosis was found present in a very small percentage of cases and never presented itself as a marked complication.

Many patients were given repeated analgesia at short intervals without noticing any tolerance for the drugs. One patient (reconstruction of a congenital absence of the ear) received the analgesia

seventeen times in the course of four years without noticing any untoward symptoms or drug tolerance.

Individuals, who were known to take a poor general anesthetic, as, for example, alcoholics, did very well and the amount of ether required was greatly reduced.

Such formidable procedures as laryngectomies and radical sinuses were carried out without any supplementary analgesia, with the patient at all times co-operative and responsive, and were not followed by any symptoms of shock.

Time, in regard to the duration of the operation, was a negligible factor, as the narcosis was smooth and of uniform depth for a number of hours.

Excessive secretions in the pharynx were not present unless ether was given by the drop method as an accessory anesthesia, and, therefore, no atropin was employed.

There was no excitement stage present during the induction of the analgesia.

At no time was there any cyanosis or loss of body heat, as patients could breathe freely moist, warm air.

The pulse and heart action were somewhat slower than usual, and the respiration also slower and more shallow. Little or no change was noted in the blood pressure.

Postoperative analgesia was required in less than 0.5 per cent of the cases and then only in small amounts.

A distinct advantage was found in having the patient neither frightened nor apprehensive, so that a great deal of psychic reaction as well as shock were eliminated.

Signs of irritation of the gastro-intestinal tract or respiratory tract were never present nor did the patients complain of any thing referrable to same.

Asepsis was greatly facilitated by absence of the ether mask and hands of the anesthetist.

The recovery from this analgesia was rapid; was not followed by lack of appetite; nor was there any tendency to mental depression.

This report has been made on the basis of our clinical experience, and while there are factors which may be interpreted as still challenging the absolute safety of synergistic analgesia, we feel that a series like ours should lend impetus to further study by ourselves as well as other groups, and then only can we hope to arrive at a more definite technic in applying this method. We have not stressed the subject of synergistic analgesia in children, but we have gone about employing the method in children rather cautiously and still continue

to do so. However, we hope that, through more experience, we shall be able to substitute some other drug for morphin in order to make it more applicable in the group of younger patients. We have attempted, in a small group of cases (children) to use ether according to Gwathmey's advice on the basis of giving an ounce of a 50 to 65 per cent solution of ether in oil for every twenty pounds of body weight. The results in some cases are quite satisfactory. Morphin, in small doses, and chloretone suppositories have, in some instances, produced excellent narcosis, although perhaps our lack of good results in children is due to our timidity in the use of morphin in the young.

A word as to the paraldehyde in combination with the ether may not be amiss here. It is a known fact that the paraldehyde in the mixture intensifies the action and insures complete relaxation without affecting the pulse rate or the respiration. However, we recommend that the amount be carefully checked and minimized to the extent of using only about 1 to 2 dr. to the average adult dose.

In connection with our first detailed report, we published, in the form of a preliminary report, the work of H. Ross and O. C. Pfeifer on animals. This work was done in the Department of Pharmacology, University of Illinois Medical College, under the guidance of Prof. Hugh McGuigan. Further work is being carried out with special reference to the ether-concentration of the blood and a more certain determination of the dosage required.

The conclusions which were drawn from these animal experiments, while authorized by the results of such experiments as we performed, were, nevertheless, not sufficiently established to be more than mere suggestions as to the relative effects of morphin and ether in ether-oil anesthesia. The following conclusions were reached: *1*, Anesthesia cannot be induced by the rectal method of the administration of ether-oil unless morphin is previously administered without requiring so large a dose as to produce intestinal irritation, diarrhea, colitis, and probably death. It does not seem possible that so large an amount of ether in so small an amount of the oily solvent can be crowded into the large intestine without producing a solitis of some degree; *2*, the dose of both morphin and ether is a variable factor since an individual idiosyncrasy toward both cannot be overlooked; *3*, an indirect proportion, within certain limits, exists between the dose of ether and morphin. Our safest results seem to suggest a high morphin dose with a correspondingly lowered ether dose; *4*, when anesthesia is produced by this method, it is an ideal one. We have observed the heart rate and respiration rate of animals for two and

three hours and found no change in either. There exists a rate of absorption and excretion, or rather, a ratio which, when once established, remains constant throughout.

In these above mentioned experiments the magnesium sulphate and paraldehyde were omitted and the fact was established that the degree of anesthesia produced has been dependent, not on the amount of ether used, but on the relative amounts of ether and morphin, and of these, morphin seems to play the major role. While we feel that there may be great discrepancies in comparative work on animals, it is only in this mode of experimentation that we can modify and change our mode of procedure without jeopardizing human life.

While we realize that in the question of anesthesia, this number is infinitesimally small, a start must be made somewhere to get to a series of such magnitude as to make logical statistics from, for example, a series of 50,000 to 100,000 cases. We wish to again call attention to the fact that this form of analgesia is not to be confused with any other of the colonic anesthesias as has frequently been done. Our reports as to the experimental and clinical phases of synergistic analgesia are not those of overly-enthusiastic investigators, for we fully realize the present shortcomings of our procedure, but we do hope that the work so far done will stimulate further investigation along the same lines.

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2551 North Clark Street.

SYNERGISTIC ANALGESIA IN HEAD SURGERY WITH SPECIAL REFERENCE TO NOVOCAIN, MAGNESIUM SULPHATE AND MORPHIN.*

DR. JAMES J. KING, New York.

The value of magnesium sulphate and morphin as a synergist in general anesthesia was called to my attention first by Dr. Gwathmey in 1921. As a result, I immediately began clinical tests with the combination in conjunction with local anesthesia. After numerous clinical observations Gwathmey established the fact that morphin may be given in a 25 or 50 per cent solution of chemically pure magnesium sulphate instead of plain water and that in this combination the therapeutic value of the morphin is increased from 50 to 100 per cent.

At my suggestion, Dr. Hooper, Director of Experimental Medicine of the H. A. Metz Laboratories, carried out chemical and biological studies with magnesium sulphate. He prepared for me ampules containing a sterile solution of the pure chemical.

In 1923 in a paper, "Tonsillectomies in Adults Under Local Anesthesia", I made a summary of 1089 tonsillectomies on private patients. In 542 cases local anesthesia was employed. As a preliminary medication ⅛ grain of morphin dissolved in 2 c.c. sterile 25 per cent solution of magnesium sulphate was administered hypodermatically. The first injection was given one hour before operation and repeated one-half hour later. The tonsils were then infiltrated with 0.5 per cent novocain solution and enucleated. These magnesium sulphate and morphin injections produced an analgesic effect so that a very small amount of the local anesthetic was required. This was the first paper published in which magnesium sulphate and morphin were used as a synergist in novocain local anesthesia in head surgery.

About this time I was successful in bringing Dr. Gwathmey and Dr. Hooper together and in an extensive investigation they have established the synergism between magnesium sulphate, novocain and morphin, and also between magnesium sulphate and ether. Novocain acts synergistically with respect to the magnesium sul-

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phate, increasing greatly the analgesic and anesthetic potency of the solution when injected hypodermatically or intramuscularly without increasing the toxicity. The addition of the novocain to the magnesium sulphate-morphin combination increases the therapeutic efficiency of the solution at least 25 per cent and allays any irritation that may be caused by the magnesium sulphate. It also prevents the nausea and vomiting that frequently follow the use of simple morphin solutions. This solution may be successfully employed whenever morphin is indicated. The 2 c.c. ampule will abolish pain for three or four times as long as when morphin alone is given.

As a result of this work Dr. Hooper developed ampules containing magnesium sulphate with novocain, and magnesium sulphate with novocain and morphin. These ampules are prepared in an exact manner after a large amount of careful research and clinical work. They are prepared from specially tested, chemically pure products and freshly distilled water. The solutions are sterile and will not produce local reactions or sloughs when injected intramuscularly with asepsis.

With this work as a basis, I have used two or three intramuscular injections at one-half hour intervals of 2 c.c. sterile 50 per cent solution of magnesium sulphate combined with 2½ per cent novocain and ⅛ grain of morphin sulphate as a preliminary medication to local anesthesia. During the past year this preliminary has been used in approximately 100 tonsillectomies, in which 0.5 per cent novocain solution was infiltrated around the tonsils. In about 20 additional patients the tonsils have been removed without the aid of local infiltration or general anesthesia. In six patients one tonsil has been removed after injecting, in the usual way, 0.5 per cent novocain around one tonsil, and the other tonsil removed without the aid of local injections.

Two or three intramuscular injections of 2 c.c. sterile 50 per cent solution magnesium sulphate with 2½ per cent novocain and ⅛ grain of morphin at one-half hour intervals before local anesthesia is wholly satisfactory for nearly all patients. The addition of the novocain not only definitely increases and prolongs the analgesic effect of the magnesium sulphate-morphin combination, but it also entirely prevents the burning sensation complained of by many patients when ordinary hypertonic solutions of magnesium sulphate are injected.

The analgesia produced by the three intramuscular injections alone was sufficient and satisfactory in only about one-third of the

selected cases in which the tonsils were removed without the aid of local infiltration. One of these cases was a woman, age 70 years, who was quite feeble, thin and anemic. Her tonsils had been treated by the X-ray and were full of pus from a chronic infection. I was afraid of an extension of the infection by injecting around them. After two injections of the magnesium sulphate-novocain-morphin combination in the deltoid the tonsils were enucleated without pain. In some cases of peritonsillar abscess the tonsils have been enucleated without local infiltration around the tonsils.

I have used this synergistic analgesia in tonsillectomies only, but believe that it may be employed successfully in all ear, nose and throat operations where a general anesthetic is either contra-indicated or not desired. It seems especially indicated in conjunction with local anesthesia for mastoidectomies where the co-operation of the patient is not essential and where general anesthesia is contra-indicated.

While I have done tonsillectomies in selected patients (quinsies, aged and the septic) under its general analgesia, I believe its greatest usfulness will be found as a synergist and preliminary medication to local novocain anesthesia. In addition to its use as a preliminary medication for local anesthesia it also has great possibilities in the field of general analgesia when both general anesthesia and local injection of novocain are contra-indicated.

SUMMARY OF TECHNIC AND DOSAGE.

For the average individual weighing 130 to 150 pounds, three intramuscular injections are usually required.

1. The patient should not be allowed food after midnight when operating in the morning and not after 9 a. m. when the operation is scheduled for the afternoon.

2. Three hours before the operation is to take place administer intramuscularly deep into the thigh, deltoid or subscapular region 2 c.c. sterile 50 per cent solution of magnesium sulphate combined with 2½ per cent novocain and ⅛ grain morphin.

3. Thoroughly cleanse the site of injection with iodin and alcohol and be sure the needle and syringe are absolutely sterile.

4. The lights should then be dimmed, the patient kept quiet and the surrounding conditions should be conducive to relaxation.

5. Repeat the intramuscular injections at half-hour intervals until two or three doses have been administered, as may be required by the individual patient.

6. One hour or one hour and a half after the last injection the patient should be carried to the operating room on a stretcher and

transferred to the operation table; it is very important that the patient should not exercise even to the extent of walking to the operating room after he has received the preliminary medication.

7. The patients must be carefully observed and considerable judgment exercised in regard to the dosage for different persons. As the morphin is the most potent drug in the combination idiosyncrasies for morphin must be recognized and dosage given accordingly.

8. If toxic symptoms arise, treatment, as in morphin toxicity, must be instituted.

9. As the local anesthetic, 0.5 per cent novocain is employed.

40 East 41st Street.

UNSUSPECTED CASE OF OTITIC CEREBELLAR ABSCESS. OPERATION AND RECOVERY.

Dr. E. Trible Gatewood, Richmond, Va.

Patient consulted me last June, complaining of pain and discharge from left ear. He was a white man, age 30 years. His past history was of no special importance.

Present illness: Patient states he was seized with pain in the left ear six and a half months ago, which increased in severity for three days, at which time it began to discharge, giving him some relief.

A week later the intense pain returned and the discharge lessened in quantity. He then consulted his family physician, who punctured the drum. This gave him complete relief for a short time.

The ear continued to discharge freely but his pain returned and his doctor punctured the drum again, but he was never able to get entirely free from pain. His treatment then consisted of ear drops, aspirin—as high as 20 tablets a day—and occasional puncture of the drum. This state of affairs kept up over a period of six months, at which time he came under our observation.

Patient state he has lost about 20 pounds in weight. Has had no headache, vomiting or vertigo.

Examination showed a rather thin individual, who appeared to have a slightly fixed attitude of the head. Patient had a normal gait and there was no spontaneous nystagmus. The ear showed marked tenderness over the antral region only; percussion over the lateral wall of the head gave no pain whatever, nor was there any tender-

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ness or swelling over the mastoid cells proper. Deep pressure could be made over the tip or posterior region without the slightest discomfort. Inspection of the drum membrane showed a thick, soggy, bulging condition with a small perforation in its upper posterior half, discharging tenacious pus as fast as it was wiped away, showing it to be under pressure. His temperature was 99° and pulse 74. The case was regarded as a simple mastoiditis that was neglected, and patient advised to enter the hospital for an operation, which he immediately did.

A blood count showed luecocytes to be 5800, polys. 70, Hb. 85, urine negative.

Patient was operated upon the following day. The usual mastoid incision was made and an unusually small antrum opened, which was filled with pus under pressure; the mastoid bone was very dense and of the nonpneumatic type; just a few cells being found in the zygomatic region and they contained granulation tissue. Finding such a small antrum and so few infected cells, it was readily seen that there must be infection elsewhere to account for the quantity of pus that was seen coming from the auditory canal previously.

The dura of the middle fossa was exposed high up, but it looked normal in appearance and no exploratory stab wound was made in the temporo-sphenoidal lobe. There were no signs of an epidural abscess in this locality. The posterior fossa was then gone into through the mastoid bone just anterior to the knee of the lateral sinus, which was situated far posteriorly. The dura was exposed and a fistulous tract was found filled with granulations, leading into an abscess in the lateral hemisphere of the cerebellum. Judging from the use of the probe the abscess was about the size of a small orange. The dural perforation was enlarged on account of its minute opening with a bistoury which, was followed by an outflow of pus. The drainage consisted of a fenistrated rubber tube well anchored into the cavity. The usual dressing applied and tube shortened by degrees at subsequent change of dressings. Patient made a good recovery, never running a temperature over 100° and leaving the hospital in two weeks.

This case is of interest from the standpoint of the size of the lesion taken in conjunction with an absence of the most common symptoms of cerebellar abscess, *i. e.*, headache, vomiting, vertigo, slow pulse, nystagmus, incoordination, or visual disturbances.

The ear drum in all probability acted as a safety valve, thereby eliminating intra-cranial pressure.

Professional Building.

RADICAL MASTOIDECTOMY.*

Dr. E. B. Dench, New York.

I have been asked to make a few remarks upon the technique of the radical operation in chronic middle ear suppuration and your secretary in sending me the notice has written me that he desires to have me bring out the entire technique, including "the methods of holding chisels, curettes, and rongeurs".

It seems to me that in dealing with operations in special surgery too much stress has been laid upon just the points which your secretary has asked me to consider, while the operators themselves have not always had the clearest conception of the objects to be fulfilled in performing the operation. To attempt to tell one individual how to use a particular instrument has always seemed to me to be a mistake. It is wiser, I think, for him to have a distinct idea of what is to be accomplished and then to use for the purpose the instrument or instruments which his own experience has taught him that he uses most easily.

The object of a radical operation is to remove all diseased bone from the middle ear and the adjacent bony structures, and to leave a perfectly smooth cavity in the bone which will dermatize either from without inward or as the result of the application of a skin graft, applied either primarily or secondarily. In the formation of this cavity, it is essential in order to obtain a dry ear that due care be taken to obliterate the Eustachian tube, so that as a result of an inflammatory process within the nasopharynx the mucous membrane lining the tube may not proliferate and spread over the cavity at the expense of the epidermis which already lines it or is supposed to line it. It is necessary that there be no recesses in the operative cavity, so for this reason the posterior tympanic space and the inferior tympanic space must be completely obliterated, and the facial ridge must be lowered to the extreme limit of safety so that the antrum, tympanic vault and mastoid cells will constitute one large cavity, and that no small recesses be left in which secretion can accumulate.

The removal of bone in forming this cavity can be done with a variety of instruments. Personally, I presume that I use the gouge more than any of my colleagues. This is because, in my own hands,

*Presented at the Section on Otology, New York Academy of Medicine, Oct. 10, 1924.

I feel safer in using the gouge than some of the other instruments. Many work equally well, however, with the curette. In performing the operation my first object is to expose the horizontal semicircular canal and with this as a landmark to thoroughly remove all diseased bone, not hesitating to expose the dura or sinus if necessary. Particular attention must be paid as before stated to the complete obliteration of the posterior tympanic space and the hypotympanum. My own practice is to do the major part of this work with the gouge, finishing up with the curette. No recesses must be left, no matter to what extent the bony walls must be removed nor how closely we come to the facial nerve, as long as this structure is not wounded. For cleaning out the Eustachian tube I use a small sharp curette, always directing the cutting edge of the instrument upward and forward so as to avoid possible injury of the internal carotid artery.

After the cavity is formed, it is necessary to enlarge the meatus sufficiently to obtain perfect aeration of the cavity. Too large a meatus is unsightly, but in some cases, particularly in children, it is better to err on the side of making too large a meatus than to be content with one of insufficient size. No radical cavity will remain dry unless it is freely ventilated. My own method of enlarging the meatus is to cut a conchal flap, base upward, remove the cartilage from this and then bend it back on itself and suture it to the anterior flap with continuous chromic gut suture. To secure a dry cavity and particularly to preserve or improve the function of the organ, my own preference is to apply a primary skin graft at the time of the operation. This, I do in every case, unless at the time of operation, I find the ear very foul. The primary graft should never be employed in cases suffering from an acute exacerbation of the chronic condition. This, I consider hazardous. Exposed dura or sinus are not contraindications to the use of the primary graft. In fact, cases where the dura is exposed heal much more quickly than the cases where it is not exposed. In cases suffering from an acute exacerbation, in cases where we are not certain that the exenteration has been carried completely beyond diseased tissue and in cases of labyrinthine fistula, wounds of the labyrinth, sinus or dura, primary grafting is naturally contraindicated. These cases may be grafted secondarily in from one to three weeks after the operation.

The Tiersch graft should be moderate in size and my experience has been, that in some cases, too large a graft is difficult to manipulate. The graft is made to fit the cavity snugly, by first carefully placing it over the cavity, depressing it slightly in the center, seeing that the margins of the graft are in contact with the walls of the

cavity, and then exhausting the air from below the graft by means of a pipette, after the manner of Ballance. The pipette is carried along the anterior wall of the cavity until it reaches the tympanic orifice of the Eustachian tube. Suction then causes the graft to drop snugly into the cavity and to approximate itself to the walls by atmospheric pressure. The graft is then held in place by small pledgets of cotton. The deepest pledget, the one introduced over the Eustachian tube, is usually mounted upon a black silk suture so that it may be recognized. Usually from five to eight cotton pledgets are required to hold the graft in position. The cut meatal margin is also covered with the graft. Sometimes one graft is sufficient to line the entire cavity and to cover the cut meatal margin, sometimes two or even three grafts are overlapped. The best results are always obtained by covering the meatal margin with the graft; the posterior wound is then closed with Michel clips, and the pledgets are removed in from four to six days. The clips are taken out at the end of from 48 to 72 hours.

If the secondary graft is employed, usually the same technique is followed. The posterior wound is always opened, granulation tissue which has formed in the cavity is removed, so as to leave a thin firm bed of healthy granulations. Bleeding following the removal of these granulations is controlled by packing the cavity with 1 to 1000 adrenalin for a few moments. I may say also that adrenalin is used throughout the entire primary operation to obtain as bloodless a field as possible.

This, I think, describes the operation as completely as can be done in the time allotted to me. I have said nothing about any special technique in cutting the Tiersch graft. The great requisite is a sharp razor, the skin of the thigh, or from whatever part of the body from which the graft is taken must be stretched tightly, and this tension must be kept up as uniformly as possible throughout the entire process of cutting the graft. Bearing these two things in mind no one of average normal dexterity will have the least difficulty in securing a graft of sufficient size to line the cavity.

A word about the after treatment. The cotton pledgets are removed from the cavity, usually, between the fourth to sixth day. The subsequent treatment is very simple. My own plan is to cleanse the cavity by mopping it out with peroxid of hydrogen, full strength, and drying it with cotton pledgets and subsequently dusting boric acid powder over the walls of the cavity, for about ten days after the operation. Subsequently, after the cavity has been cleansed with peroxid, I mop the interior of the cavity thoroughly with about 60

per cent alcohol. It will be remembered, of course, that only the deeper layers of the graft take, and that the superficial layers will always exfoliate. The use of the peroxid and alcohol aids this exfoliation. Of course, there will be small areas over which the graft will not adhere. After cleansing the cavity in the manner described equal parts of boric acid and scarlet red will hasten dermatization. If during the process of exfoliation, the discharge becomes rather profuse the ear may be syringed once or twice daily with a normal salin solution. Too frequent irrigation, however, is not to be advocated. Dermatization is usually complete in from two to four weeks after the operation.

15 East Fifty-third Street.

TIME RELATIONS OF TUNING-FORK HEARING WITH THE FORK AT DIFFERENT LOCATIONS.

DR. DOUGLAS MACFARLAN, Philadelphia.

1. With a fork, C_{256} (vibrating with such intensity that it is heard by BC 90 seconds, by AC 180 seconds), the relation of hearing by BC over the mastoid antrum to hearing with the "butt" of the fork in the external auditory meatus is that in the latter position the hearing lasts 20 to 30 seconds longer.

2. The relation of BC (Weber, with the fork on the brow) to BC over the mastoid antrum was as follows: Testing fork,—C_{256} (n/ hearing,—BC 30″; AC 75″). BC Weber: BC antrum: 15: 25, 20:30, 23:29, 23:33 (these are four consecutive tests made on the same normal individual; the figures represent seconds).

3. The relation of the BC Weber on the brow, to BC by upper teeth conduction was as follows,—(fork C_{256}, BC 30, AC 75). BC Weber: BC upper teeth: 15:45, 20:45, 23:40, 23:45 (consecutive testings on the same individual; the figures are seconds).

4. Time hearing relations of,—BC Weber on brow: 20, 23, 23; BC on mastoid antrum: 30, 29, 33; BC on upper teeth: 45, 40, 45; BC and AC "butt" of fork in EAM: 60, 75, 75; AC at the EAM: 75, 75, 75. (Three testings on the same individual.)

The insertion of the "butt" of the fork in the external auditory meatus, holding it continually until its tone is gone, produces a dead-

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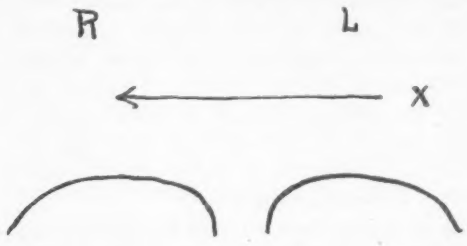
ening of hearing to AC when the fork is removed. This dullness is recovered from in 10-20 seconds, but it lasts long enough to upset a comparison between hearing with the fork in this location and with the fork at EAM. In other words, the fork must not be shifted from one position to another without making a fresh blow. Dean and Bunch have confirmed the finding of dullness of AC after wax has been removed.

It is noticed that the BC from the upper teeth is better than that from either the forehead or the antrum. This is singular because the mouth undoubtedly acts as a resonator, and thus though increasing the inital intensity of the sound, should exhaust it sooner.



In taking the Weber from the upper teeth it is impossible to see to what degree a deaf person can lateralize the sound, as can be done by shifting the "butt' of the fork on the brow. This valuable suggestion, as well as that of timing the Weber, comes from MacKenzie; it is quickly performed and adds greatly to the information given by the test.

The accompanying cut illustrates the author's method of graphically recording the Weber test. The arched lines represent the eyebrows. the cross marks the spot where BC-hearing is no longer lateralized, in short where the tone is heard equally in both ears; the arrow denotes the lateralizing direction.

1805 Chestnut Street.

STUDY OF STREPTOCOCCUS HEMOLYTICUS IN TONSILAR CRYPTS.*

DR. CURTIS C. EVES and DR. W. R. WATSON, Philadelphia.

Our attention was especially attracted to this subject during the examination of something over 450 children attending certain private schools in the suburbs of Philadelphia in the falls of 1922 and 1923. Besides an examination of the ear, nose and throat, a culture was taken from the tonsils of every child who still possessed them. These children, of an age ranging from 11 to 20 years, were individuals living in what might be termed the higher strata of social life and among the most approved hygienic surroundings. We make this statement with the view of directing attention to a curious phenomenon which occurs in further and later studies of cases obtained from a neighborhood where the question of hygiene is, to say the least, primitive, the findings of which we have tabulated below, together with the results of cultures obtained from the school children and a hundred cases from our private practice, as well as a series furnished by Dr. Russell Richardson.

In the group of cases we have referred to as living in poor hygienic surroundings we were careful to select only such tonsils as appeared to be perfectly healthy from which to take our cultures and, moreover, it may be stated that the throats of the school children already spoken of were in the majority of cases also lacking in acute pathology. Our idea in doing this was to prove beyond all doubt in our minds that the normal tonsil actually harbored the streptococcus hemolyticus, as a rule. But in the series of cases we report as furnished by Dr. Richardson, as well as in the hundred cases we cultured in our offices, the tonsils were palpably diseased. Our findings, as tabulated, are as follows:

Cultures taken from 170 students in "H" school, fall of 1922; 58 per cent were carriers of hemolytic streptococcus. Of this series 17 or 10 per cent were carriers of an almost pure culture. 44 or 25 per cent were carriers of a flora in which the hemolytic strep. predominated. 29 or 17 per cent were carriers of an equal number of colonies as of other micro-organisms. 9 or 5 per cent were carriers of hem. strep., but in which other organisms predominated.

Cultures taken from 100 students in "H" school, fall of 1923; 75 per cent were carriers of hemolytic streptococcus. Of this series

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31 or 31 per cent were carriers of an almost pure culture. 18 or 18 per cent were carriers of a flora in which the hem. strep. predominated. 17 or 17 per cent were carriers of an equal number of colonies as of other micro-organisms. 9 or 9 per cent were carriers of strep. hem., but in which other organisms predominated.

Cultures taken from 62 students in "G" school, fall of 1923; 84 per cent were carriers of hemolytic streptococcus. Of this series, 17 or 27 per cent were carriers of an almost pure culture. 19 or 30 per cent were carriers of a flora in which the hem. strep. predominated. 9 or 14 per cent were carriers of an equal number of colonies were of other micro-organisms. 7 or 11 per cent were carriers of strep. hem., but in which other organisms predominated.

Cultures taken from 100 patients in private practice referred for examination of tonsils to determine as to whether they might be the seat of focal infection. Of this number 70 per cent were carriers of hemolytic streptococcus to the following extent: 46 per cent contained large amounts of pure culture of hem. strep.; 20 per cent in moderate amounts with other organisms; 20 per cent carried large amounts of streptococcus viridens; only 10 per cent failed to carry either.

Careful cultures taken from the deep crypts of 75 dispensary adult patients since the spring of 1924 showing no pathology of the tonsils, with the following result: 13 patients or 17 per cent carried strep. hem. in large amounts; 3 patients or 4 per cent carried strep. hem. in small amounts; 11 patients or 14 per cent carried strep. viridens in moderate amounts.

Series of cases furnished by Dr. Richardson in which the tonsils were culture, together with a control culture taken from the mouth. Of this series there were 212 throats cultured, of which 39 were negative, 51 doubtful, and 122, or 57 per cent, were positive.

Thus, it may be seen, so far as our own researches are concerned, that the natural habitat of the streptococcus hemolyticus is the crypt of the tonsil. We are more than supported in this contention by other observers, who go so far as to say that the further one gets away from the crypt the scarcer this organism becomes. For instance, I. Pilot and D. J. Davis, in their article published in the *Journal of Infectious Diseases*, of April, 1919, state that "it is worthy of note that hemolytic streptococcus were found on tonsilar surfaces in a decidedly higher percentage (61 per cent) than in the pharynx (43 per cent)." Of interest, too, is the occurrence of hemolytic streptococcus in the crypts in 97 per cent as compared with 61 per cent on the tonsilar surface. Parenthetically it may be stated that

Nakamiera, in the Annals of Surgers, January, 1924, concludes that streptococci occur more commonly and in larger numbers than other bacteria in the parenchyma of extirpated tonsils. He states also that the incidence and relative numbers of hemolytic streptococcus increase with the coming of cold weather and the prevalence of tonsillitis and allied conditions.

Therefore, speaking from the viewpoint of the pharyngologist, the fact being fairly well established that the home of the hemolytic streptococcus is in the crypt of the tonsil, we have asked ourselves the following questions:

1. What is the significance of the incidence of this organism in the tonsil crypt?

2. What role does it play, if any, in either the prevention or cause of disease?

3. Is it, *per se*, of such a sinister character as it is pictured, or, in other words, has the medical profession properly gauged the potentiality of this organism for its supposedly excessive ill effects in certain conditions?

With reference to the first question we must frankly confess our ignorance in the subject. Hypothetically, we assume that the organism is found in purer culture and more often in the crypt because of its isolated position, away from such influences as would tend to weaken its growth, but what its significance is is still a mooted question, so far as we are concerned. It may, indeed, have no significance whatsoever, other than that certain organisms are found everywhere. And this fact we would accept without the trouble of any further research in the matter if it were not that the hemolytic streptococcus was so consistently the predominating organism in the majority of cases we have had under observation. Since this is so, and in quite a number an almost pure culture was returned, we have formed the opinion that its presence in the crypt is not purely coincidental. As a tentative explanation we can easily conceive of a theory in which the streptococcus hemolyticus was in its inception an ordinary streptococcus of no particular family, which, in the adaptation of itself to an environment of germicidal influences, such as acids and alkalis of the mouth, as well as tooth washed, gargling fluids, etc., sought a home less dangerous to itself, and in the evolution of its life cycle acquired a proteolytic character by which it was able to liquify the plug of mucus covering the mouths of the crypts, and thus eventually arrived at its final haven in the extremity thereof. And we know, of course, that through evolution certain organisms common enough in the beginning may finally become specialized

and take on an importance out of all proportion to their original form.

As to its role in the cause and prevention of disease, we seem to have fairly good evidence in the belief that the betahemolytic streptococcus plays a very beneficent part in the prevention of acute tonsillitis. Quoting from an article published by Felty and Bloomfield in the Johns Hopkins Hospital Bulletin, of November, 1923, they state that "in a previous paper it was pointed out that people who were tonsil carriers of the betahemolytic streptococcus failed almost uniformly to develop tonsillitis, whereas the incidence of the disease in those who were not carriers was over 40 per cent". In another paper published in the same bulletin they also state that "it has been possible very definitely to define susceptibility to tonsillitis. Carriers of betahemolytic streptococcus are practically immune. Non-carriers are highly susceptible."

We have been unable to find any confirmation of these rather radical statements by Felty and Bloomfield in the literature, but in order to corroborate in part the truth of their statements we have certainly noted so frequently in our own work in the hospitals and in our offices that certain tonsils which would impress one as being on the point of blooming into frank inflammation, seldom do so, and on inquiry the patients invariably deny ever having had tonsillitis, notwithstanding their tonsils possessed all the classical appearances of being sites of a focal infection. We have no doubt, therefore, that these latter forms of tonsils were strongly fortified by the presence of the beta type of hemolytic streptococcus.

This immunity for tonsillitis, in our opinion, is not through any inherent virtues donated by the betahemolytic streptococcus itself, but an acquired immunity through the tonsil receiving small doses of the emanation of an especially virulent type of the organism over long periods of time. This would make it appear that in our estimation the beta type of hemolytic streptococcus is not so benign as it would seem to be. We mean, of course, that in association with other more virulent micro-organisms which may invade the system in sufficient numbers, it is capable of turning against its host to become a very real menace and potent auxiliary in certain complications. This is best explained by citing from an article published by J. Martin Beattie in the *British Medical Journal*, of Nov. 12, 1921, as follows:

"It is significant that in the various infections a common starting point is the throat. One of the earliest symptoms is 'sore throat' and in such cases the hemolytic streptococcus can generally be demonstrated in large numbers, and this same organism is found later in

the complicating lesions. Taking an average of several observers in four common diseases, the prevalence of these hemolytic streptococcus is striking: Scarlet fever, 131 cases, 91 per cent; measles, 538 cases, 72 per cent; influenza, 340 cases, 70 per cent; lobar pneumonia, 151 cases, 50 per cent."

And again he states that "Pilot and others in 1918, during the pandemia of influenza, isolated hemolytic streptococcus from the lungs in 43 per cent of the cases. Cole and MacCallum state that the hemolytic streptococcus is the chief, if not the only cause of broncho-pneumonia following measles."

The general consensus of opinion seems to be, therefore, that the streptococcus hemolyticus, especially the beta type, when alone and confined to the tonsilar tissue, is of a benign and charitable character. In the presence of other pathogenic micro-organisms, however, it becomes the chief offender in many complications.

This partially but not completely answers our third and last question. If one were to ask indiscriminately all medical men that he met, "What do you think of the streptococcus hemolyticus?", almost invariably one would get a sombre shake of the head and the reply, "Very bad—very bad!", or, as one of our colleagues answered us, "When he is good, he is very, very good, but when he is bad he is horrid." Which reply, when it is analyzed, although somewhat frivolous, seems to approach the truth as nearly as one can get to it in the present light of our knowledge of the hemolytic streptococcus.

Incidentally, we wish to invite attention again to the discrepancy in the laboratory returns from the series of cases obtained from the Pennsylvania Hospital Dispensary, as compared with the cases from the private schools mentioned. As we have already intimated, the individuals composing these groups are living under entirely different hygienic conditions; those coming from the dispensary, as you already know, being members of the great unwashed proletariat, and the school children living in almost ideal surroundings.

Why this discrepancy exists we are not prepared to say. It would seem that where a collection of individuals are grouped together, such as school children, internes, nurses, etc., the percentage of carriers of the hemolytic streptococcus is more consistently found as compared with cultures taken from a scattered community, irrespective of their hygienic condition.

In summing up the evidence for or against the streptococcus hemolyticus, therefore, we regret that we have nothing new to offer except substantiation of a fact that has already been amply proven; that the home of this organism is in the crypt of the tonsil; that it

has a benign influence on the tonsil itself; that, theoretically, it may, in certain specialized physical conditions, be the etiological factor in some of the infectious diseases; and lastly, that it has been pretty well proven to be associated in many of the complications of all infectious diseases.

A word in conclusion to record a few other facts which came under our observation during the study of the cases as above cited:

In none of these series did we find any microscopic evidence which would enable us to determine the presence or absence of any one class of organism. Deeply congested bands along the margins of the anterior pillar and pharyngeal wall, as well as congested tonsilar tissue, may be found from infection of any of the more virulent organisms. Neither has it been possible to determine the character of the infecting organism by the amount, consistency, or color of the secretion expressed from the crypts. Until more definite evidences are produced by the laboratory one must determine the advisability of removing diseased tonsils upon the history of the patient, the appearance of the tonsil and surrounding tissue, the amount and character of the secretions expressed from the tonsil, and the condition of the cervical glands. In doubtful cases a culture taken from the deep crypts showing a predominance of any form of streptococcus, pneumococcus, etc., should influence one to advise removal.

247 S. Seventeenth Street.

EUSTACHIAN TUBAL CURETTAGE.*

Dr. Sidney Yankauer, New York.

When the Chairman of the Section asked me to say a few words about the curettage of the Eustachian tube my first impulse was to decline, for the reason that for the past few years my hospital work has been limited to rhinology, bronchoscopy, etc., and my ear work has been limited to what has been done in private practice. There are, however, three phases of this subject upon which I wish to speak. In preparing the patients, it has been my custom to irrigate the ear through the Eustachian tube with a catheter passed through the nose, using a pressure bottle. About three-fourths of the irrigating fluid will come back through the nose, but a good stream will come through the external auditory canal. This procedure is a very useful one. It cleans out much pus and mucus which could not be reached in any

*Presented at the Section on Otology, New York Academy of Medicine, Oct. 10, 1924.

other way. However, it is dangerous if the drum membrane is not open. It happens often that there are adhesions between the margin of the typanum and the inner tympanic wall; this bridge of tissue will sometimes extend along the floor or along the roof, making a fistulous tract. When these adhesions are cut, the irrigation is perfectly safe. Such irrigations are not only useful in preparation for operation but are also useful in the terminal stages of an acute otitis media. The secretions can be cleaned out and the recovery facilitated by this means.

The second, is the operation of ossiculectomy. The technique of this operation has been perfected, but the operation has been allowed to fall into disuse. The reason of the failure of ossiculectomy to cure the condition is the failure to include the closure of the tube in the technique. If this is done, a much larger percentage can be cured.

The third phase of the subject is one of the reasons why curettage of the tube sometimes fails to cause closure, and that is because of the neglect of the canal for the tensor typmpani muscle. This canal is genrally described as a bony canal, but the wall which separates the tenson from the tube is never a complete bony wall; not only are there dehiscences in the wall of the canal, but the inner end of the canal is open and the muscle fibres of the tensor tympani take their origin from the cartilaginous tube. Now, in the chronic suppuration when the malleus has been removed, either by disease or by operation, the mucous membrane covering the tensor tendon has been opened and the tensor muscle has rotted away, leaving the tensor canal open at both ends. The inner end of the tensor canal is exposed, so that even though the bony Eustachian tube is completely closed by granulation tissue there is still a communication between the pharynx and the middle ear through the tensor canal. This fact should be borne in mind, and in curetting the tube care should be taken to remove the bony wall between the tensor canal and the tube itself. That is not such a simple matter, for if we remember that just behind the tube lies the bony wall of the cochlea, and that the tensor canal which lies in relation to the tube lies posterior to it, when you are curetting in this region and the curette slips through, it makes you think of the cochlea and you are apt to get a shock. The curette should expose the entire part and make one cavity of the two canals. I do not know whether the surgeons who are doing many radical operations have given this matter the attention which it deserves. Perhaps it is only a small detail, but it is just as important in curetting the tube in the radical operation, as in curetting the tube through the intact bony canal.

BLINDNESS FROM TEETH, TONSILS AND ACCESSORY SINUSES.*

DR. LEON E. WHITE, Boston.

The word "blindness" at once suggests a deprivation so overwhelming that many would choose oblivion rather than existence without that wonderful gateway through which passes most of the impressions making life worth while, and without which the struggle for existence becomes so handicapped that not a few are compelled to seek charity to keep body and soul together. The hope that some of these victims would be benefited by a better understanding of the whys and wherefores of loss of vision from infections in the sinuses, teeth or tonsils has stimulated me to continue the investigation commenced twelve years ago. To this end various phases of the subject have been studied and papers read and published on the anatomical relations of the optic nerve, the literature, the diagnosis, the prognosis, the etiology, the pathology, treatment by aeration, etc., and more recently two papers, one "An Anatomical and X-ray Study of the Optic Canal", and the other "The Treatment of Optic Nerve Involvements as Determined by Optic Canal Radiographs". Within these various papers are detailed reports of fifty-nine cases.

Since learning how to measure the optic canals some of the views expressed in earlier papers have been modified and are here reconsidered. But first let me give you a few extracts from the literature which is voluminous and dates back to Beer in 1817. In 1886 Berger and Tyrman gave a brief review of the previously reported cases of blindness, some twenty-six in number, arising from sphenoidal disease, and noted that the bony wall separating the nerve from the sinus was frequently of only tissue paper thickness.

Onoidi in 1908 said: "Our observations have shown that the wall between the last ethmoid cell and the canalis opticus is nearly always as thin as tissue paper; dehiscences in the walls of the accessory cavities have been found, there the diseased mucosa may come into direct contact either with the dura mater or the optic nerve sheath."

Normally, according to Loeb, "the optic nerve may be described as passing externally from the chiasm along the roof or lateral wall of the sphenoid and in close relation with the ethmoid labyrinth *only* at the posterior external angle of the last cell".

From Schaeffer's book on "The Nose and Olfactory Organ" the following is quoted: "It is essential that the intimate anatomic rela-

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tionships which exist between the paranasal sinuses and the optic nerve and commissure be understood by ophthalmologists and rhinologists. It is established that disease of the paranasal sinuses may lead to an optic neuritis, even to blindness. Of the paranasal sinuses, the sphenoidal and the posterior ethmoidal especially concern us in this connection."

"After the optic nerve passes beyond the vicinity of the posterior ethmoidal cell it diverges more and more from the ethmoidal field and is no longer in intimate relationship with the other ethmoidal cells." This brief review suffices to show how thoroughly the relations of the optic nerve to the accessory sinuses has been worked out so that no one can question the fact that the sphenoids and posterior ethmoids are the only sinuses in intimate relation with the optic nerve and to reach the tissue adjacent to the nerve the direct and logical route would be through these structures and not through the entire ethmoidal labyrinth.

The diagnosis is naturally of major import. The symptoms in the ordinary cases of acute optic or retrobulbar neuritis are quite typical. Associated with the loss of vision there may be discomfort about the eye or lameness on moving it. Occasionally there is slight exophthalmos, this condition indicating an inflammatory process in the orbit. Pupillary changes and ptosis are found occasionally. There is frequently nyctalopia, a central scotoma for colors, enlargement of the blind spot and contraction of the fields. The patients generally say that things at first were blurry when looking straight ahead, but comparatively clear when viewed sideways. Changes in the fundus are of great diagnostic value, varying as they do from the normal to a commencing pallor in some cases, and in others to a marked redness and swelling about the nerve, with engorgement and tortuosity of the retinal veins. It is essential that these inflammatory swellings be differentiated from the edema due to intracranial pressure.

The anterior portion of the nose frequently appears normal. The one vital point to determine, in the nasal examination, is the size and position of the middle and superior turbinates. Do they block the ventilation of the posterior sinuses? Is there impaired aeration? It takes but a slight obstruction to interfere with the ventilation and the mistake is frequently made of expecting to discover marked changes; while on the other hand, whenever there is no blocking of the normal openings of the posterior sinuses, this region can, I believe, be ruled out as a causative factor in the neuritis.

The following is quoted from Stark, who expresses well the thought I wish to convey: "From a nasal standpoint we must not expect to find the common symptoms of sinus infection: pus, polypus,

history of nasal discharge, etc., as we are dealing with a closed sinus; otherwise we should not have pressure. . . . The deflected septum and middle turbinate tightly pressed against the lateral wall should always be suspected."

Over half the cases give a history of a recent coryza or a prior influenza, but in a few there is no history of infection. It is impossible to determine dental infection by a superficial examination of the teeth, many appearing normal even when abscessed, so that no examination is complete without a careful filming of every tooth. It is not always possible to determine the health or disease of a tonsil. Any enlarged cervical gland below the angle of the jaw is practically diagnostic. Congestion about the pillars or soft palate usually indicates infection. It is imperative that careful radiographs should be made of the accessory sinuses and optic canals. Whenever the sinuses are negative, the teeth and tonsils should be suspected. Tonsils at all suspicious, with teeth and sinuses negative, should be removed. The diagnosis many times must be made largely by exclusion. In all cases the patient should undergo a thorough physical and neurological examination. One should consider in turn blood, urine, hysteria, pellagra, lues, tobacco, alcohol, lead, arsenic, quinin, etc. While investigating time is a very important element and it is essential that needless delay be not encountered. Practically all necessary tests can be made within forty-eight hours. Pituitary disease, brain tumor and multiple sclerosis, while not usually producing such sudden loss of vision, must always be borne in mind. As a matter of routine the various cranial nerves and lobes of the brain are tested. Not a few cases with brain tumor have had various nasal operations before they were correctly diagnosed. Within the past year I have been guilty of removing tonsils and opening the posterior sinuses in two cases, but not until they had been thoroughly investigated at the Peter Bent Brigham Hospital and discharged on the assumption that there was no intracranial condition to account for the loss of vision. These cases, while not typical of accessory sinus blindness, had sufficient pathology in the nose and throat to warrant making an attempt to benefit their vision by this procedure. They were not benefited and both have since been operated upon for suprasella tumors. The knowledge derived from these patients has great assisted me in correctly diagnosing three recent cases with intracranial tumors. Careful investigation should prevent unnecessary operating. One should systematically go over each case before advising operation and convince himself that the eye condition in all probability originates from that which he proposes to open or remove, be it accessory sinuses, teeth or tonsils.

Etiology: The earlier writers considered the mere presence of pus in the sinuses the all sufficient explanation for the disturbance about the optic nerve, and while this may undoubtedly be the cause in some instances, it is by no means the usual or the only one. The nerve is ordinarily protected by the barrier thrown out by inflammatory processes so that it is rarely involved unless through some anatomical abnormality. In only a small percentage of my cases has pus been found. Hyperplasia has been emphasized by others as the chief cause, and while hyperplastic tissue may involve the posterior sinuses, it has seemed to me from my study of the sections and cases that it would better be considered a predisposing factor rather than the principal etiologic condition. Hyperplasia undoubtedly renders the sinuses more vulnerable. The etiology seemed to be explained in most of my cases either by the size and position of the middle and superior turbinates or from infection in the teeth or tonsils.

Pathology: I have undertaken the consideration of this subject under five heads, namely: *1* Direct extension; *2* toxemia from some infective process; *3* bacteremia or focal infection; *4* hyperplasia; *5* anaphylaxis.

1. By *direct extension* infections in the posterior sinuses probably extend by continuity of tissue to the optic nerve. When, however, there is an infection in a more remote sinus (an antrum for instance) it may become walled off before the nerve is reached. Should the infection persist, there may be forced into the system a certain amount of bacteria and toxins, which, in turn, can produce an optic neuritis.

2. *Toxemia.* It is conceded that retrobulbar and optic neuritis can be caused by alcohol, lead, tobacco, quinin, optochin, arsenic, lues, etc., so that reasoning by analogy there is little doubt but that toxins originating in the accessory sinuses, teeth or tonsils, or for that matter anywhere in the body, may have similar action on the optic nerve.

3. *Bacteremia:* It has been demonstrated by Billings that infectious microorganisms may be carried in the blood stream or by the lymph channel from the foci of infection in the teeth, tonsils and accessory sinuses to the terminal blood vessels in various regions of the body. He has shown how the inoculated blood vessels become more or less occluded by endothelial proliferation and leucocytic infiltration and that the bacteria escape through the vessel walls into adjacent tissue, so there would seem little doubt but that bacteria may also travel via the blood stream and lymph channels to the optic nerve.

4. *Hyperplasia:* As a predisposing factor hyperplasia is probably of considerable importance. It undoubtedly renders the accessory sinuses more vulnerable. Hyperplasia plus infection and direct extension to the optic nerve is probably of far greater consequence than the mere fact that the tissue has become hyperplastic.

5. *Anaphylaxis:* Stark has advanced the theory that there is a "sensitization of the tissues of both the sinus and the orbit by the bacterial proteins, producing an allergy resulting in a localized anaphylactic reaction each time the individual comes in contact with a fresh infection of the same bacteria in the nose, and possibly in other parts of the body. For that reason many of these cases give a history of attacks resembling hay-fever, or acute coryza, shortly previous to the eye trouble." While I have had a few cases presenting symptoms similar to those mentioned by Stark, it had not occurred to me that this would satisfactorily explain the pathology. It is, I believe, a valuable suggestion. There certainly seems to be a similarity between some of these eye conditions and certain anaphylactic reactions comparable to asthma and hay-fever. As sinus infections frequently cause asthma, it is conceivable that they might also produce engorgement about the optic nerve.

Prognosis. The prognosis depends largely upon the duration and extent of the loss of vision, the condition of the fundus, the virulence of the infection and the size of the optic canal.

Duration. The conclusions reached from an analysis of the cases were that unless there was improvement under treatment within a week there was danger of permanent impairment of vision, while in cases of more than two months' standing little could be expected except possibly checking the loss of vision by the removal of some definite focus of infection.

The amount of vision. It was also found that the demand for early operative interference in total loss of vision was more imperative than when the loss was but partial.

Condition of the fundus. When the nerve appears normal one might, with safety, delay operating much longer than where there is increasing engorgement, or commencing pallor.

The *virulence of the infection.* As in all the other types of infection, so in that producing optic neuritis, the microorganisms differ greatly in virulence. When the infection is of the virulent type, there is probably considerable exudate about the nerve or even within its sheath. The optic nerve, as you know, is really not a nerve but a part of the brain. It is easily destroyed and does not regenerate. Parsons says of it: "The so-called optic nerve, together with certain parts of the retina, constitutes a lobe of the brain, and has therefore

the characteristics of the central nervous system. Hence the nerve-fibres are devoid of a sheath of Schwann and the interstitial substance is neuroglia."

The *size of the optic canal.* That the osseous optic canals normally afford great protection to their neural contents cannot be doubted, but when these canals become narrowed and the enveloping sheath of the nerve, or the nerve itself, swollen, the unyielding walls may cause constriction sufficient to produce atrophy. Before mentioning the treatment, I wish to discuss the size and shape of the optic canal as it is a new subject and one to which I have devoted many hours within the past year. Piersol gives the diameter of the optic nerve as from 3 to 4 m.m. In a canal of 4 m.m., therefore, only a moderate swelling would cause a pressure so severe that degeneration of the nerve would rapidly ensue. The importance of filming the optic canal to determine adjacent pathology has been emphasized by van der Hoeve. This study was undertaken partially to substantiate his assertions but more especially to determine if there was any relationship between the size of the canal and the vulnerability of its contents. About two hundred skulls were examined at the Harvard Medical School and the results tabulated; the size, shape and position relative to pneumatization were noted. Roentgenograms were made of the optic canals in all available cases of optic nerve involvements, old and new, to determine the size and shape in the old cases and in the new ones to also ascertain any evidence of pathology. As a check, radiograms were made of twenty-five supposedly normal individuals. For this X-ray work I am indebted to Dr. A. S. Macmillan.

Up to the present, with the exception of pituitary cases, I have been able to find in the X-ray plates but little evidence of pathology adjacent to the optic canal. Possibly this is due to the type of infections largely responsible for the neuritis as these happened to be mostly from teeth and tonsils. I regret, moreover, that I cannot agree with van der Hoeve as to the importance of finding purulent sinusitis adjacent to the canal. It has been rarely possible to discover acute infections within the posterior sinus by the X-ray, while in the chronic cases which show pathology in the film, nature has walled off the infection from the nerve.

The important thing to determine is the size and shape of the optic canal. Adjacent pathology, while always sought, is not so easy to determine and many cases undoubtedly require surgical interference where it is not evident. The average diameter of the optic canal is given by Whitnall as from 5 to 6 m.m., while Wilbrand and Saenger give the average as high as 7 m.m. The canals were measured in 164 adult skulls, the average diameter being 5.17 m.m. The 5.5 and

6 m.m. canals were all round and only two had extensive pneumatization about them. Seven of the 164 canals of 5 m.m. were slightly oval.

Four were triangular and but twelve showed extensive pneumatization. Of the 4.5 m.m. canals (twenty in number) twelve were oval or flattened at the top and practically all were from two-thirds to three-quarters surrounded by pneumatic sinuses. The three canals of 4 m.m. were all oval or irregular. Two were nearly surrounded by pneumatized sinuses. The third was in a very dense skull and was probably due to hyperostosis.

The canals were usually found to be round irrespective of the way examined, *i. e.*, by holding them up to the light, by the fluoroscope, or the X-ray. The top posteriorly was occasionally flattened and in a few cases the canal appeared distinctly oval with the horizontal diameter usually the larger. Early in the measurements it became apparent that excessive pneumatization of the sphenoid adjacent to the canal was usually associated with diminution in its caliber. The thinness of the bone separating the inner wall of the optic canal from the sphenoid was noticeable in many specimens and in a few dehiscences were found, but as these might have resulted from cleaning the skulls, it was thought best not to tabulate them.

The size of the optic canal in infants and children is most instructive. The skulls of forty still-born infants were examined fluoroscopically. Of these it was possible to make out the canal in twenty. In two the canal was oval, and in the rest approximately round. In none was it less than 4½ m.m. in diameter.

Thus it would appear that the diameter of the optic canal at birth is nearly of adult size, but very short. There is a rather close analogy between it and the annulus tympanicus. The canal seems to reach adult size early in life judging by measurements obtained from a few children's skulls. Of six canals in skulls from children under three years, four were round and two slightly oval and all approximately 5 m.m. in diameter. The four canals from skulls seven to eight years old were all round and all of about 5 m.m. The canals did not appear in these few specimens to be in very intimate relationship to the pneumatic sinuses. Uniformity in the radiograms was obtained by having all the work done by one radiologist. To obtain the normal size and shape of optic canals twenty-five doctors, nurses and attendants at the infirmary were filmed. Five of the fifty canals in this normal series were slightly oval, *i. e.*, the vertical diameter was ½ m.m. shorter than the horizontal. The average diameter was 5.35 m.m. Twenty-five cases with optic nerve involvement were then filmed: twenty-six of these canals were oval. This makes 50 per cent oval

as against 10 per cent in the normal series. Several of these were filmed a second or third time in an endeavor to get correct positions. In ten there was 1 m.m. difference between the vertical and horizontal diameters. In the others about ½ m.m. In nineteen of these twenty-five the optic nerve was involved. The average diameter of the canals of the patients with optic nerve involvement was ⅔ m.m. less than the normal series.

The following is Dr. Macmillan's description of the correct position for filming the optic canal: The position in which a patient is placed for a radiograph of the optic canal is of extreme importance, as a slight variation in the position would so change the outline of the canal as to render its measurements worthless. Holding a dry skull in the hand and looking at the optic canal through the orbital cavity it is evident that the true shape and size can be seen only when the axis of the optic canal goes through the lower outer quadrant of the bony rim of the orbit. The optic canal in the living can be thrown into this area when the patient is lying face down with the malar bone, nose and lower jaw touching the plate, the central ray directed straight down. If the upper rim of the orbit is allowed to touch the plate, the optic canal will be thrown too high in the bony frame of the orbit and will be distorted. The diameter of an optic canal of 5 m.m. would be enlarged about ½ m.m. in the radiograph of a living subject.

In a study to determine what influence the size of the canal had on the best method of treatment, thirty-six cases with optic nerve involvement were analyzed.

SUMMARY OF THE FINDINGS IN 36 CASES OF OPTIC NERVE INVOLVEMENT.

In ten cases the vertical diameter was 4 m.m. or less and all were oval. Two of these were benefited but slightly, if at all, by operation. One unoperated case had complete optic atrophy. Another refused operation and was unimproved. Four cases improved greatly after the opening of the posterior sinuses but there remained marked temporal pallor. One required a tonsil operation and the remaining case, unoperated upon because of poor general health, has had frequent recurrences. These were, by far, the most serious cases in the series.

There were ten cases with canals approximately 4.5 m.m. in the vertical diameter and of these but three were oval. Four had the posterior sinuses opened and all recovered with practically normal vision. Five had teeth or tonsils removed and all these made good recovery. The remaining case recovered under local treatment. It

is interesting to note that in these 4.5 m.m. cases every one recovered with practically normal vision.

There were eleven cases with optic canals 5 m.m. in the vertical diameter and of these but two were slightly oval. In three chronic cases where the etiology was in doubt one showed marked improvement after removing the tonsils. A septum and tonsil operation on the second was followed by slight improvement. The third case, with progressive blindness, was temporarily improved in health and relieved of severe headaches, but later had a brain tumor removed. Four acute cases had the posterior sinuses opened; normal vision in three and but slight improvement in the fourth. The neuritis in this case was apparently not of nasal or dental origin. Three acute cases recovered under local treatment. The remaining case made a good recovery following the removal of tonsils and middle turbinate. Of the eight acute cases seven recovered with normal vision, and in the obscure eighth case tabes or multiple sclerosis is suspected.

There was one case with canals 5.5 m.m. in diameter. In one eye there was optic atrophy of many years' duration; the other eye of six weeks' standing, improved rapidly after the removal of abscessed teeth.

There were three cases with canals abnormally large, *i. e.*, 6 m.m. One of these, a case with progressive loss of vision, continued to fail after the sinuses were opened and the tonsils removed. The neuritis was later found to be due to a suprasella tumor. In the second case the vision returned to normal after the removal of the foci of infection in the mouth. The third case, untreated, had complete optic atrophy of two years' duration, probably from either abscessed teeth or an optic nerve tumor.

Further analysis of this data reveals that in the ten cases with canals of 4 m.m. or less, diseased teeth were extracted in one and in another the tonsils were removed.

Treatment. If future cases substantiate the results in those already studied, it will mean that whenever we are dealing with canals of 4 m.m. or less, the appropriate treatment in a case of severe optic nerve involvement will be the immediate ventilation of the posterior sinuses to prevent atrophy, unless some other definite focus can be found.

A 4.5 m.m. canal does not demand such radical treatment. Optic atrophy, while possible, is less to be feared. The posterior sinuses, unless blocked or evidently diseased, rarely need to be opened. Local medication may be given a reasonable trial. In canals of 5 m.m. or over the neuritis is probably not a direct extension from the sinuses and recovery from any acute attack may be expected either spon-

taneously or under local treatment. Later the focus should be sought and, if found, eliminated, be it in teeth, tonsils or sinuses, as the toxins from long continued infection can produce atrophy even in normal canals. Local treatment is usually a 10 per cent spray of argyrol and adrenalin about the middle turbinate, followed by hot irrigation or suction. When no definite explanation can be found for sudden and persistent loss of vision in a patient with a canal of 4 m.m. or less, the operation advocated as a therapeutic measure is the removal of the middle turbinate, a larger opening in the front wall of the sphenoid and the uncapping of the posterior ethmoid cell,—a simple and comparatively safe surgical procedure to one at all skilled in intranasal technic. The complete ethmoid exenteration, unless the cells are definitely infected, does not seem to me either a justifiable or necessary procedure.

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BRONCHOSCOPY IN THE TREATMENT OF ASTHMA—OBSERVATIONS ON TWENTY-ONE CASES.*

Dr. Robert M. Lukens, Philadelphia.

The object of this paper is to report the findings in a number of cases of asthma treated in the Bronchoscopic Clinic of the Chest Department of the Jefferson Hospital. The number of cases is far too small to justify any positive conclusions, but the results are suggestive of what may be done in certain types of asthma. It requires observation on a thousand cases to determine the value of any one treatment or procedure. This is particularly true of asthma for which, perhaps, more "cures" have been "discovered" and abandoned than in the case of any other disease.

It is important to remember that any disease so diverse in its etiology as asthma will not respond to any one method of treatment, and it is equally important to determine the treatment for each individual type of such a complex disease.

Great stress has been laid upon protein sensitization as an important cause of asthma and the treatment, with some degree of success, has been directed toward elimination of the exciting protein or to desensitize the patient by subcutaneous injections of an extract of the specific protein.

Various foci of infection undoubtedly have been the cause of certain cases and asthmatics have been cured or relieved by cleaning out chronic suppurative nasal sinuses or by the removal of polypi and correction of basic pathological changes in the structure of the nose. Carious teeth and infected dental alveoli have undoubtedly been at the bottom of some asthmatic attacks, although doubtless many a sound tooth has been sacrificed without relief. The focal infective type of asthmatic etiology is only one of many. Elimination of the source of infection, therefore, will or should benefit only a certain percentage of cases.

During recent years attention has been directed toward lung suppuration as an etiologic factor, and we believe that in the course of time certain types of so-called bronchial asthma will be treated by bronchoscopic methods as a regular procedure,

*Accepted thesis for membership in American Bronchoscopic Society.

because they are the most simple and direct means of reaching the basic lesion.

It is justifiable to perform diagnostic bronchoscopy upon almost all asthmatics, if done under strict surgical technic, and only after the preliminary examinations for prospective bronchoscopic patients, as laid down by Dr. Chevalier Jackson, have revealed no contraindication.

The tracheo-bronchial findings endoscopically may be secondary to some focus of suppuration elsewhere and it is obvious that cleansing of the tracheo-bronchial tree alone will not effect a cure in such cases. It is also obvious that bronchoscopic treatment will not effect cures in dyspnea of cardiac, renal, or gastrict origin; however some of these cases have been relieved to a certain extent by removal of viscid and tenaceous mucus from the trachea and bronchi. What part bronchoscopy will play in the neurotic cases, we are unprepared to say. Dr. Louis H. Clerf has had the experience of producing an apparent cure after a single passage of the bronchoscope without any other treatment. This he thinks was a case of neurotic origin.

Fifteen of the cases in this report had been under observation and treatment for varying lengths of time at the Asthma Clinic of the Department for Diseases of the Chest of the Jefferson Hospital under the direction of Dr. A. R. Vaughn, who referred them to the Bronchoscopic Clinic of that department because of the failure of these cases to respond to the routine and special procedures as carried out in asthma clinics.

The majority of these cases showed, bronchoscopically, good reasons why they were unbenefited. The predominating picture was that of suppurative tracheo-bronchitis. Whether this was the *cause* of the asthma or merely acted as an obstacle to producing a cure, which otherwise might have been effected, it is difficult to say. However, thorough cleansing of the tracheo-bronchial mucosa and the instillation of appropriate remedies greatly lengthened the periods between attacks after a few treatments.

The endoscopic findings in the cases treated in this clinic may be divided into four groups.

A. Those cases with chronic suppurative tracheo-bronchitis.
B. Those with chronic catarrhal tracheo-bronchitis.
C. Those with cyanotic mucosa without suppuration.
D. Those with urticarial patches.

Group A is composed of those cases in which there was an abundant muco-purulent material more or less tightly adherent

Case	Sex	Age	Group	Duration of Disease	Probable Cause	Frequency of attacks before bronchoscopic treatment	Previous special treatment	Number of Bronchoscopies
7	F	62	A	15 yrs.	Pan-sinusitis Arteriosclerosis	daily	General tonic	2
12	F	21	—	8 mo.	——	Every three weeks sometimes lasting a whole week	Submucous-resection. Tonsillectomy	16
13	M	59	A	2 yrs.	——	Daily	Stock vaccine	16
15	M	52	A	17 yrs.	Sinusitis Nasal polypi	Nearly every night Some attacks lasted several days	Vaccine Adrenalin Morphine Nasal Surgery	2
16	M	60	A	3 yrs.	Influenza	Nightly	Autogenous vaccines	2
17	M	36	A	32 yrs.	——	Increasing frequency	Submucous-resection. Tonsillectomy	10
18	M	36	C	9 yrs.	——	Irregular	Autogenous vaccine	5
19	M	64	B	12 yrs.	——	Several times a week	Autogenous vaccine	2
22	M	52	A	2 yrs. and 6 mo.	Nasal polypi Influenza	Several times a week	Polypectomy Autogenous vaccine	15
24	F	45	A	3 yrs.	——	Nightly	Autogenous vaccine	11
26	M	51	A	9 yrs.	——	One to several times a day	Adrenalin	4
33	F	31	D	5 yrs.	Goose feathers Orris root Rabbit fur	Irregular	Protein desensitisation	2
42	M	58	C	1 mo.	Cardio-renal	Several times a day	Symptomatic	2
43	M	44	A and C	3 yrs.	Pan-sinusitis nasal polypi	Daily	Polypectomy	6
45	F	64	A	4 yrs.	Influenza (?) goose feathers	Daily	Stock Vaccine Goose feather extract	6
46	M	54	C	6 yrs.	Repeated "colds"	Night and day	Adrenalin	6
55	M	40	A	6 yrs.	Cardiac	Irregular	General	4
60	M	47	D	Several years	——	Daily	"all kinds"	4
61	F	20	B	11 mo.	Tonsillitis	Nightly	Tonsillectomy	6
64	F	36	A	Several years	——	1 to 6 daily	Stock vaccine	5
65	F	29	A	7 yrs.	Followed a gynecologic operation	Frequent	——	2

	Number of Bronchoscopies	Duration of bronchoscopic treatment	Medication per bronchoscope	Result of bronchoscopic treatment	Remarks
	2	6 months apart	Aspiration and 20% argyrol	No change	
	16	4 ½ months	Aspiration of right middle lobe abscess Asthma Solution	Improved	Post tonsillectomy abscess cured
	16	1 year and 3 months	Aspiration and asthma solution	Improved	Triangular collapse of trachea during expiration
	2	1 week	Aspiration and Asthma solution	Improved	
	2	1 week	Aspiration and asthma solution	Improved	
	10	1 year	Aspiration and asthma solution. Later 2% guaiacol in mineral oil	Improved	
	5	2 months	Asthma solution	Improved	
	2	3 weeks	Asthma solution	No change	Triangular collapse of trachea during expiration
	15	1 year	Aspiration and asthma solution	Improved	
	11	10 months	Aspiration and asthma solution	Improved	
	4	4 weeks	Aspiration and asthma solution	No change	
	2	2 weeks	Asthma solution	Improved	
	2	2 weeks	Asthma solution	No change	
	6	3 months	Aspiration and asthma solution	No change	
	6	2 months	Aspiration and asthma solution	Improved	
	6	2 months	Asthma solution	No change	
	4	5 months	Aspiration and asthma solution	Improved	
	4	3 months	10% silver nitrate to wheal and asthma solution	Improved	Marked bulging of party wall of trachea causing expiratory obstruction
	6	2 months	Aspiration and Gomenol	Improved	
	5	2 months	Aspiration and asthma solution	Improved	
	2	1 week	Aspiration and Gomenol	No change	

to the mucosa of the trachea and bronchi. This material was found to extend from just below the larynx down the entire trachea and both main stem bronchi and which terminated usually at the orifices of the branch bronchi. The secretion of the branch bronchi was of a more mucoid character and was much less abundant.

This secretion presented several characteristics. In some cases the exudate seemed to be uniformly spread over the entire mucosa in a rather thick layer with, here and there, an elastic bridge stretching from side to side of the trachea and bronchi. In other cases the exudate was of a more lacey character and resembled finely teased out raw cotton spread out over the mucous membrane through which the mucosa appeared as under a veil. In the other cases the exudate appeared as fairly thick grayish-white placques, thickly adherent, forming islands on the inflamed mucosa. Upon removal by suction or swabbing, the underlying mucosa did not appear to be any more inflamed than the surrounding membrane, nor was ulceration or erosion of the underlying structure detected except in one case.

In Group B the predominating picture was one of a rather intense inflammation in which the mucosa was angry red and velvety in appearance. There was only a moderate amount of secretion, which was not purulent.

Group C comprises four cases. The murosa of the tracheo-bronchial tree showed distinct cyanosis, which was more apparent here than on the other mucous membranes, although the cyanosis was general. One of these cases was bronchoscoped during an attack and probably should belong to Group A because of the thin veil-like muco-purulent secretion covering the mucosa. In this case the cyanosis persisted and never entirely disappeared although the asthmatic attacks finally ceased.

Group D consisted of two cases. In one case the mucosa of the trachea and bronchi was normal in appearance excepting in the right stem bronchus just below the spur of the upper lobe bronchus, where there was a slightly raised, intensely red, rounded spot which extended half way around the bronchial wall. This was observed only once in this patient; it was never present in subsequent bronchoscopies. In the other case there were several inflammatory spots in the stem bronchi.

In three cases (two in Group B and one in Group C) a fairly severe but short attack of asthma was precipitated by the first bron-

choscopy. All three cases were recovered sufficiently to leave the hospital in less than two hours after the treatment.

One case had an associated bronchiectasis. This patient was a man 58 years of age. It is probable that the asthma was preceded by the bronchiectasis as the asthma dated back only nine months. The bronchiectasis was discovered by a routine Roentgen-ray examination by Dr. Willis F. Manges before bronchoscopy.

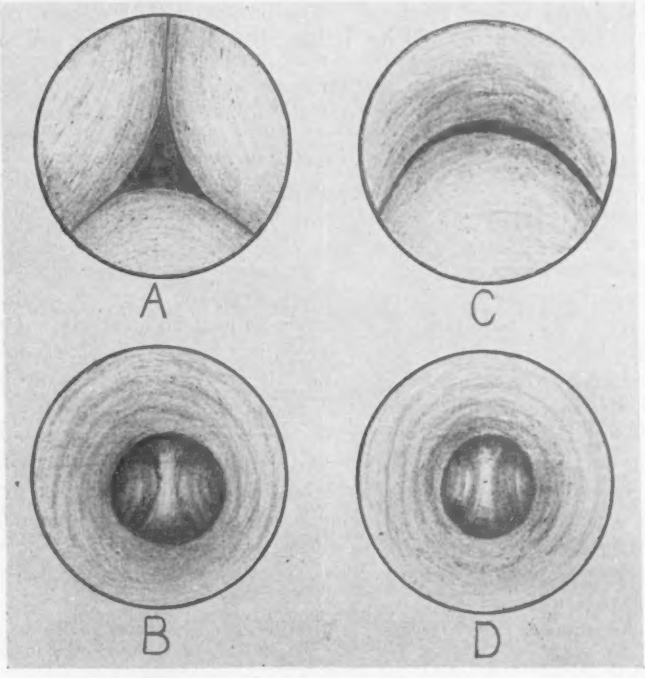
Another case was complicated by pulmonary abscess in the right lower lobe. In this case the pulmonary abscess followed a tonsillectomy performed to relieve the asthma. The asthma was not relieved by the tonsillectomy. The patient was referred to the Bronchoscopic Clinic chiefly to have the abscess drained, rather than with any thought of benefitting the asthma. The treatment in this case consisted in draining and irrigating the suppurative area, followed by instillation of "asthma solution". She was discharged after the sixteenth bronchoscopic treatment with the abscess cured and free from asthmatic attacks. She remained free from asthmatic attacks for about a year, when she had a recurrent attack.

Collapse of the Trachea: A peculiar condition hitherto undescribed has occurred in two of our cases of asthma and in one case in the care of Dr. Louis H. Clerf; namely a collapse of the trachea during expiration. On inspiration breathing was accomplished easily, but respiratory difficulty was extreme on expiration. The first patient in which this phenomenon was observed (Case No. 13) had stopped work eight months before admission to the Bronchoscopic Clinic and was unable to walk a city block without sitting down and resting. The first bronchoscopy was done during a severe attack. On introducing the bronchoscope, breathing ceased for several seconds and the bronchoscope was withdrawn. The same thing occurred on the second introduction a few minutes later, but, instead of withdrawing the bronchoscope, this time it was allowed to remain in the trachea until the spasm relaxed, opening up the trachea widely. On the next expiration the trachea collapsed again and presented the picture as illustrated in Fig. 1 (A). This phenomenon occurred with every breath until the bronchoscope was inserted almost to the carina, when the patient breathed freely as long as the tracheal walls were supported by the bronchoscope. The bronchi did not participate in this collapse. As shown by the illustration the collapse of the trachea did not resemble the narrowing of the lumen with the bulge of the posterior wall of the trachea as is seen in cough during bronchoscopy. This appeared to be an entirely different thing. In the asthmatic cases, the two lateral walls fell inward using the anterio-median line of

the trachea as a hinge and with the posterior wall forming an isosceles triangle with concave sides.

In a fourth case there was expiratory dyspnea caused by tracheal obstruction, but in this case the airway was crescentic (Fig 1, C) being formed by the posterior wall bulging into the lumen of the trachea and almost occluding it.

The reason for this three-sided collapse on expiration is obscure. It would be easy to explain if the collapse occurred on inspiration



as a result of obstruction in the glottic or subglottic region with negative air pressure in the trachea and would be due to a sudden creation of a partial vacuum, but in these three cases there was no obstruction and there was a positive air pressure in the trachea. Furthermore, it occurred during expiration.

The only explanation that I can offer is that these patients had emphysematous chests and that when the abdominal muscles were contracted forcibly to expel the air, the lungs were crowded up-

ward and the weakened walls of the trachea were overcome by the pressure and were forced inward. A sort of vicious circle was formed—a certain amount of expiratory dyspnea requiring the aid of the abdominal muscles, which in turn by acting too forcibly still further increased the dyspnea by indirectly collapsing the trachea. This may be the reason for marked dyspnea in certain cases of asthma.

Treatment: The treatment of this series of cases was of course both general and local, but it is not within the scope of this paper to discuss the general treatment. The bronchoscopic treatment consisted mainly in ridding the trachea and bronchi of the pus and abnormal secretions.

Morphine, gr. ¼, was given by hypodermic injection and cocain 10 per cent aqueous solution was locally applied to the laryngopharynx before bronchoscopy, except when the patient was having an attack of asthma. In order to get a correct impression of the endoscopic appearance of the trachea and bronchi during an asthmatic attack uninfluenced by drugs, either general or local, no morphine nor cocain was used when the patient came to the Bronchoscopic Clinic during an attack. There seemed to be no special difficulty in bronchoscoping these patients without an anesthetic. This may have been partially due to the patient being more or less narcotized by the attack or to having his attention taken up by his trouble much in the same manner as in the old story of putting a chip of wood under a balky horse's tongue to divert his attention; but we are more and more impressed with the needlessness of sedatives or local anesthetics for bronchoscopy. Usually after the first or second bronchoscopy morphine is rarely given in any case, and cocaine locally, used at first to reduce spasms of the larynx and so prevent trauma, is in most cases dispensed with after the patient learns to relax.

Appropriate sized Jackson aspirating bronchoscopes were used in all cases.

In the Group A cases the aspirating channel of the bronchoscope was frequently too small in caliber to remove the thick, tenacious material and in these cases the regular Jackson velvet tip aspirating tube was used.

At the diagnostic bronchoscopy specimens of bronchial and tracheal secretion are taken by swab and by collector for laboratory examination and for the preparation of autogenous vaccines. We are indebted to Dr. George R. Moffitt, of Harrisburg, who attended the Clinic regularly to make inocculations of culture media with the secretions and to take care of the specimens as soon as they

were obtained, and for making the autogenous vaccine used in this series of cases.

After thorough cleansing, 10 per cent solution of silver nitrate was used in the Group D cases to touch up the urticarial patches and in the Group B cases to swab over the most intensely inflamed areas. Two and one-half cubic centimeters of "asthma solution" (adrenalin hydrochloride, 1: 10,000 sol., m. xx; cocain hydrochloride, 10 per cent solution, mx; to normal salt solution oz. 1) was instilled into each lower lobe bronchus.

Other medications used by instillation in these cases were: Five to ten cubic centimeter doses of 1 per cent solution of menthol in mineral oil; 2 per cent guaiacol solution in mineral oil; and 20 per cent gomenol solution in mineral oil.

Those cases which responded to bronchoscopic treatment did equally well under any of the above solutions so that no conclusions could be drawn as to the relative superiority of any one solution in these cases of asthma. We believe that the cleansing and ridding of the trachea and bronchi of irritating secretions was the important factor in the treatment of the Group A cases.

Results of Treatment: Taken as a whole, the results of the bronchoscopic treatment in this group of cases were encouraging. While some of the cases aparently have been cured, it would be assuming too much to say more than that they have been improved up to the point where the asthmatic attacks have been reduced to infrequent seizures in most of the cases and in a few cases no attacks have occurred to the present writing, freedom from attacks extending over periods of many months. In the improved cases, the attacks have been shortened and are less severe than they were formerly; the ability to work has been increased; and general health and weight have been improved.

The Group A cases experienced great relief an hour or so after treatment and it is these patients who soon learn to visit the Bronchoscopic Clinic in time to prevent ensuing attacks of asthma. They report for bronchoscopic treatment at the onset of a feeling of the presence of secretion and of constriction in the chest, with productive cough. They are usually relieved for a period of several weeks following treatment. These periods of quiescence gradually increase in length; the bronchoscopic picture shows a decrease in the amount of secretion and a healthier mucosa. In two of the three cases of tracheal collapse, the collapse almost disappeared.

Conclusions: 1. Bronchoscopic drainage and treatment is a valuable aid in the treatment of those cases of asthma in which there is associated definite pathology of the trachea and bronchi.

2. No conclusions can be drawn as to the value of bronchoscopic treatment uncombined with general medical treatment as all of the cases of this series received general medical treatment including protein desensitization when indicated, and autogenous vaccine injections during the period of bronchoscopic treatment. But it is worthy of note that these measures produced no results until bronchoscopic treatment was added.

3. In this series of cases infection of the respiratory tract played an important part in defeating the cure of asthma by recognized medical procedures and was greatly overcome by bronchoscopic methods.

4. Collecting specimens of secretion from the trachea and bronchi without oral contamination can be accomplished only by bronchoscopy.

5. Bronchoscopy is a safe and valuable aid in diagnosis and treatment of asthma in suitable cases.

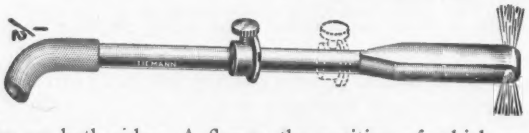
1631 Spruce Street.

A NEW TONSIL IRRIGATOR.

Dr. Sidney Yankauer, New York City.

It is my custom after tonsil operations to use irrigations of the throat with hot water. I have found this procedure to relieve the pain and to facilitate the healing more than any other single method. However, irrigation with an ordinary irrigating tip is not satisfactory as the tonsillar fossae are not thoroughly cleaned.

By this method and therefore I have devised this special irrigating tip in which the stream of irrigating fluid is discharged n the lateral



direction on both sides. A flange, the position of which can be adjusted with a set screw, is slipped over the shank and the apparatus fitted to the individual patient in such a way that when the flange rests against the upper teeth, the opening in the distal ends of the irrigator is just opposite the tonsillar fossae. Irrigation of the fossae in this way is much more effective than with the ordinary irrigating tip. It is made by Temann and Company, of New York.

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TWO CASES OF VINCENT'S ANGINA FOLLOWING TONSILLECTOMY.

DR. G. M. VAN POOLE, Honolulu, T. H.

On Aug. 24, a tonsillectomy was performed upon Mrs. W., using 0.5 per cent novocain, prepared in glass ampules, as local anesthetic. Usual antiseptic precautionary measures taken and the operation was simple; the tonsils being large and easily removed.

The day following operation, the throat looked very well and she complained of little or no discomfort so she was allowed to leave the hospital.

On the third day, she complained of severe pain on left side when she tried to swallow and said that the blandest kind of food was very irritating. Upon examination I found the tissues simply melting away at the upper end of the wound. It was rather superficial and extended toward the uvula. I took a swab culture from that region and upon examination, it was found to contain Vincent's spirillum. The surface was covered with neo-salvarsan, which was removed by a competent nurse every two hours, and she was given neo-salvarsan intravenously. In spite of all treatment, the uvula was clipped off by the disease and the resulting scar left that side in a rather ugly condition from a cosmetic standpoint. At present, she experiences no difficulty in swallowing and the voice is natural.

The second case was a Mrs. D., who had a tonsillectomy performed on Dec. 17, 1924. She progressed very nicely until Dec. 20, 1924, when she complained of severe pain on the left side which was aggravated by any kind of food. Remembering my former experience, I at once took a swab culture and found the spirillum in abundance. In this case I did not use the neo-salvarsan, but applied locally 1 per cent brilliant green, 1 per cent crystal violet in 50 per cent alcohol. I am happy to state that under this local treatment the disease did not spread and at present, Dec. 29, she is practically well.

Young Building.

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THE NEW YORK ACADEMY OF MEDICINE.

SECTION ON OTOLOGY.

October 10, 1924

Dr. Lester Mead Hubby, Chairman.

a. **Simple Mastoidectomy.** Dr. Jacob L. Maybaum.
b. **Eustachian Tubal Curettage.** Dr. Sidney Yankauer.
c. **Modified Radical Mastoidectomy.** Dr. John R. Page.
d. **Radical Mastoidectomy.** Dr. Edward B. Dench.

DISCUSSION.

DR. BLACKWELL said that those who recall the extremely painful postoperative dressings, the prolonged period of healing (usually eight to twelve weeks) and the depressed cicatrix which attended the performance of the simple mastoid operation some fifteen years ago are impressed with the striking advance which has been made in improving these distressing factors of convalescence in recent years. Some twelve years ago he had read a paper before the American Otological Society based on sixty-nine cases of simple mastoidectomy in which he had attempted to secure the postoperative result which is commonly obtained today by stressing the importance of thorough mastoidectomy; light packing; suturing the wound low down, combined with frequent dressings. At that time the paper was freely discussed and criticized as a great many members considered the measures advocated were too radical. Seven years later, however, in 1921 the author was asked to read a paper on the same subject before the same society, in which he made substantially the same recommendations, the value of which had become in the meantime more or less generally recognized and adopted and most of these had been mentioned by Dr. Maybaum in his paper.

As regards the treatment of chronic otorrhea, the author has for the past twelve years performed a number of modified radical operations with the object of not only conserving and improving the hearing but giving the patient a dry ear at the same time.

One of his early communications on this subject was read before the American Otological Society in 1916. The middle ear structures were always allowed to remain *in situ;* the posterior bony canal wall was taken down to the epitympanic ring, which was removed in its upper and outer quadrant or third; the mastoid cavity exenterated, forming one cavity with the external auditory canal as in a radical. Similarly a meatal flap cut: posterior wound sutured throughout and cavity dressed per new canal.

In the surgical treatment of chronic otorrhea there seems to be a general tendency to regard any operation having for its object the relief of the condition as a success or failure depending on whether or not the ear is subsequently dry. Comparatively little attention seems to be paid to the importance of obtaining a good hearing result, which so far this evening has not been referred to. In discussing O.M.P.C. the fault lies in nomenclature, for O.M.P.C. is not that generally speaking, but really mastoiditis, and an operation having for its object its relief should permanently drain and aerate the mastoid cavity as this is the only way by which we can surgically insure these patients against he future development of serious intracranial complications. Having satisfied these requirements by either a radical or performing a modified radical operation according to the technique as stated, after healing there should be no discharge. It sometimes happens that months later mucous will accumulate at the bottom of the wound from time to time; it has no

surgical significance as the discharge is slight in amount, intermittent, nonodorous, etc., and quickly responds to treatment. When the speaker performs a modified radical operation he prefers not to curette the tube as he believes that subsequently the hearing is much better with a patent Eustachian canal. Furthermore, the discharge from the tube can never amount to anything and readily lends itself to treatment with an exposed and aerated mastoid cavity.

He was very much interested in Dr. Page's paper and believed that the next great advance in mastoid surgery would lie in the major operative treatment of chronic otorrhea, which concerns itself not only with the cessation of the discharge but with the preservation and development to the highest possible degree the patient's hearing.

Dr. Wesley C. Bowers, referring to Dr. Maybaum's technique, said that he had nothing to add excepting that in children the sinus lies very superficially, especially at the tip, and he prefers to work upward rather than downward. He also emphasized the importance of removing the epitympanic cells: he liked to remove them until he could see the ossicles plainly, believing this had much to do with getting a dry ear in a few days, which is very important. His preference in draining the mastoid is to take an ordinary mastoid sponge, put some rubber dam about it and run it up near the antrum, leaving the tip of the sponge near the antrum, and allowing it to remain in for five or six days; at the end of this time it will come out, leaving a large opening. He never puts anything else in the cavity unless pus appears. He has been using this method for two or three years and found it very satisfactory. Manipulation of this drain causes no pain, and it leaves a nice, free opening.

Dr. Bowers said he was glad that Dr. Yankauer mentioned the tensor tympani canal. Up to three or four years ago, he himself, had been in the habit of curetting out the tube as far as he could go; in the last few years he had been throwing the two canals into one, and had been surprised at the great number of cells which surrounded the Eustachian tube, in many cases. Sometimes there is a cavity a quarter of an inch wide from above downward and an eighth of an inch in diameter. Since following this procedure, he had exposed the carotid artery a number of times but had never had any trouble; he had, also, had less trouble in getting dry ears in a radical mastoid.

With regard to the modified radical, it is a question of the location of the pathology and the amount of existing hearing. It is very seldom that he does a radical in which the hearing is better than one-quarter. Usually in these cases, there is a good deal of necrotic bone around the floor of the middle ear and around the tube; it is difficult to see how any amount of aeration could make this heal. Of course, if there is wonderful hearing and one is sure that the disease is limited to the mastoid there is no question but that the modified radical would be the operation of choice.

Dr. Dench had covered the question of the radical operation. The parts which are most neglected are the post-tympanic and hypo-tympanic spaces. The external meatus is convex with the apex pointing to the lumen of the canal and if this concavity is not removed there will be a cavity beyond which will act as a cesspool. The size of the cartilaginous meatus is very important. Dr. Bowers said he was in the habit of cutting a large meatus, especially in ward patients, so that they would be able to see all parts of the cavity and clean it out themselves. He agreed with Dr. Dench's opinion about the primary skin graft, which some men hesitate to use. In his experience, the results are more satisfactory in every way, and he had never seen any evil results except in the instances which Dr. Dench mentioned.

Dr. Kopetzky said that the discussion had been most interesting. Many points had been presented on which different opinions were held, and each man spoke from his own viewpoint. In his opinion, the best way to handle the subject presented before such an audience was to state his own views and methods and give reasons why he differs from certain views expressed, although it does not necessarily follow that the opinions

criticized are wrong and his own right. The personal equation enters a great deal in the experience one has with a given technique.

In the simple mastoid, for instance, the technique which he had followed for a great while was never to remove the edematous mucous membrane lining the aditus and coming out toward the horizontal semicircular canal. If the simple operation is properly timed, this is found very edematous, but if left undisturbed it soon returns to normal. The object of the surgeon should be to have the ear, after operation, return to as nearly a normal condition as possible. If this piece of mucous membrane is left *in situ*, you not only get better hearing results but the ear is certainly in a more normal condition than if this membrane is removed and connective tissue takes its place or the aditus becomes totally obliterated.

As Dr. Blackwell had said, closure of the wound down to the tip prevents the formation of a bad scar, but another factor in the formation of bad scars is the tearing of periosteum in retracting the soft parts in the earlier stages of operation. Bone and cortex regeneration can only take place from the periosteum; and if the periosteum is preserved and brought together, the end result will be a new bone formation of thin plate bone to make a new cortex.

Dr. Kopetzky said that the question of a modified radical operation had been settled at the meeting of the International Otological Association at Boston some years ago, and he saw no reason why the subject should again crop up. Dr. Dench's quotation of Millet's remark "that he mixed his colors with brains" and thus produced inspired works of art could be paraphrased by saying that one should mix one's technique with a great deal of pathology to achieve better operations and accomplish the objects for which they are performed. An operation is devised to remove a pathological condition; and it succeeds or does not succeed insofar as it performs this function. Good end results are obtained in proportion as a given technique removes a pathological lesion. In the modified radical operation pathology and technique do not go hand in hand. It will be noticed that Dr. Page is very cautious in his statements but he does not seem to be able to state the indications for the radical mastoid operation and he certainly has traveled far from the indications set for this procedure half a decade ago. He permits himself considerable leeway and decides on his procedure as he explores. He either stops at a modified technique or continues to perform a radical operation according to what he finds. This is very good as far as Dr. Page is concerned, but it should hardly set an example to teachers of otology to thus loosely set indications for a procedure.

One can hardly understand how the saving of diseased ossicles or the removal of a cholesteatomatous mass and the results that a cholesteatome process in the middle ear can be provided for by the modified radical operation. Not desiring to expand upon this subject, we can only express our own opinion that there are no pathological lesions which a modified radical would properly remove.

Otitis media purulenta chronica is a generic term applied to many lesions in the middle ear, all of which have one symptom in common, namely, a discharging ear. The term otitis media purulenta chronica is also applied to a chronic mastoiditis whose exudate passes out through the tympanic cavity into the external auditory meatus; and one uses this term in discussing the indications for any radical or other technique in surgery. Dr. Blackwell's technique in the simple mastoid operation leaves the patient far from the normal after operation and therefore Dr. Kopetzky has never favored this procedure in cases requiring simple mastoidectomy. Dr. Kopetzky can well conceive that cases of short duration which have all the elements of chronicity might present lesions to which Dr. Blackwell's technique could be applied, but these cases are not of frequent occurrence.

Dr. Yankauer made an excellent point about the necessity of removing the stapedius muscle and gives his technique for the closure of the Eustachian tube in another set of chronically discharging ears. On the

other hand, Dr. Kopetzky said, many of his successful radical operations had, upon later examination, shown that the Eustachian tube was patent. In this finding he agreed with Dr. Blackwell. Dr. Yankauer's excellent description of the pathological lesion which exists in many subjects—the production of adhesive bands, the walling off of the mastoid process from the tubotympanic area—shows how easy it is to irrigate through the Eustachian tube and out through the external auditory meatus and eventually to close the tube. This same argument can be employed for washing the tube the other way. The same protecting processes are there and one can, with a syringe full of alcohol, send the fluid through the Eustachian tube into the nose and thus disinfect and irrigate the same area although one does not close the tube. When these patients dry up, after having been treated by this method, they more nearly approximate the normal than when the tube is closed by the Yankauer procedure.

Dr. Kopetzky stated that all will agree that the technique of the radical as described by Dr. Dench was the proper method and that this was the way all of us tried to do it. The discussion of the pathology underlying the indications for the radical mastoid would give us a keener insight. We should not say that "we will do a radical *in these cases*", but rather that "we will do a radical in such and such a *lesion*".

Dr. Kopetzky said that in those cases where Dr. Page would do a modified radical he himself follows an entirely different procedure. He does a simple mastoidectomy and keeps the postauricular wound open for a year or two. Then, when the ear has become dry and the Eustachian tube is patent and the nasopharynx clear, a secondary plastic closes up the opening. In the meantime, while it is open, the middle ear and drum are accessible to medication.

Dr. Kopetzky said that he had never found it necessary in recent years to do a radical upon a child; and he believes that the conservation of hearing and the nearer approximation to the normal are better served this way than by doing any modified or radical operation on a child.

In closing, Dr. Kopetzky congratulated the Section upon having a symposium on such subjects and begged the members to remember that he was simply presenting his own views, based on his own experience.

Dr. George E. Davis said he wished to emphasize one feature of the discussion—what Dr. Blackwell had said about the progress of the technique of mastoidectomy in recent years, along the line of improving the cosmetic results, lessening the painful after treatment, and for primary healing. As all those present knew, he himself advocates a technique which in his opinion accomplishes all these purposes with very little trouble. In a simple mastoidectomy, it is not unusual with a blood clot dressing, for the patient to leave the hospital in four or five days with primary healing, and within a week or ten days—fourteen days at the most—the ear is dry. One of his assistants secured such a result on his first attempt at the operation.

Dr. Davis said he had no criticism to offer to the technique advocated by the essayist for simple mastoidectomy excepting that it was a little too radical. In cleaning out the additus ad antrum, as Dr. Kopetzky said, one should not be too radical. After the exenteration has been made, even if the sinus or dura has been exposed this does not contraindicate the blood clot method. There seemed to be some hesitancy with some surgeons about closing the wound if the sinus or dura was exposed; but, in fact, the wound heals quicker with said exposure. One can put a very small drain at the additus and let it come out at the lower end of the wound; let the wound fill up with blood; each day change the outer or protective dressing and remove the outer drain slightly each day, and in three to five days it can be removed entirely, when the wound will be healed. Occasionally it will break down at the lower end, but you have lost nothing it it does. Dr. Davis said he also advocated the asme method in radical mastoidectomy. It was very important to be careful and preserve the periosteum intact. He employs through and through sutures and brings the flap well over, and in a week the tissue is perfectly hard

and firm; there is no deformity whatever. As regards cosmetic results, painless and quick healing, there is no other technique that compares with it. One does nothing but an outer dressing, and there is no pain involved in that, for there is no contact with exposed surfaces, and it can be discontinued in a week. It obviates one of the most distressing features in mastoidectomy, the great pain, which in children especially is very distressing. Some persons fear the technique because they have had the misfortune of having had brain abscess or meningitis complicating. This is not due to the method but to the faulty technique of the operator. Dr. Davis said he uses no water in the wound, but fills it with alcohol, then adjusts the drain, allows it to fill with blood, closes it, and puts a dry dressing on the outside.

With regard to the radical operation, he does not consider it necessary to apply a skin graft, either primarily or secondarily. Dr. Davis said he was surprised that no one but Dr. Kopetzky had mentioned the blood clot method. You can use a small drain posteriorily in the radical operation, and also a small drain from the inner tympanic wall. Remove drains in a day or two and the blood clot will disintegrate shortly and in three weeks at most leave a dry cavity.

Dr. Maybaum, in closing, said it was interesting to realize from the discussion that at the present time there seemed to be almost full accord in regard to the postoperative care of simple mastoid wound. A few years ago the use of antiseptics and tight packing was quite the vogue. The results were frequently far from satisfactory.

As to the question of operative technique, he hardly expected unanimity and had therefore prefaced his remarks by stating that there was more than one method of doing a thorough mastoid operation. It is necessary at all times to have a definite systematic plan of exenterating the mastoid cells, to have a clear understanding of the safest way of using instruments, to know not only what to do and how to do it, but to realize what is next to be done. The grouping of mastoid cells for technical purposes as suggested by Dr. Friesner is of invaluable help.

Dr. Maybaum agreed with Dr. Kopetzky that the aditus should not be curetted. All that is done is to enlarge the aditus by introducing a small Spratt curette and reaming out the outer wall. Properly used, there is no danger of dislocating or removing the incus. I am in agreement on the question of devoting one's attention to pathological lesions. The purpose of a simple mastoidectomy is not only to remove disease tissue in the mastoid but to properly drain the middle ear; the latter is facilitated by enlarging the aditus.

It is quite gratifying to note Dr. Smith's enthusiasm for the technique of simple mastoidectomy as originally taught by Dr. Friesner. The men who have been taught this technique gain an assurance and certainty in operating which is so necessary in any operative work upon the mastoid.

Dr. Yankauer closed with a few words about the function of the ear. Some years ago he collected some statistics; 55 per cent of these cases were cured and a large majority of these were improved in the hearing with the closure of the tube; and in no instances was the hearing made worse. This matter should be considered from the physiological point of view. No one can hear by means of the drum membrane; it merely brings the vibrations to the internal ear, etc. In a chronic discharging ear, there is usually such a large perforation of the membrane that no outside vibrations can be transmitted through it and there can be no performance of function through the ossicles. In the radical mastoid operation the ossicles are always removed, and when you do that there is no possible use in having a drum membrane. Furthermore, when the Eustachian tube is closed, the drum membrane cannot close. For if the Eustachian tube were closed and the drum membrane were closed you would have a closed cavity, which cannot persist. When the Eustachian tube is closed, if the perforation in the drum membrane is watched, it will be seen to get larger. The main function of the tube is to equalize the air-pressure. If the ossicles are gone, even if there is a cicatricial

drum membrane, such a cicatricial drum membrane could not transmit its vibrations. Many patients with a chronic suppuration, either with a discharge or after it has healed, hear quite well. How do these people hear who have no drum membrane, when it is not possible to transmit the vibration through the ossicles? These people hear through the round window. Under these circumstances it is better to prevent the formation of a drum membrane, and the best way to prevent that is to get the Eustachian tube to close, for once you get the Eustachian tube to close the drum membrane will never regenerate.

DR. PAGE closed by saying that it was more interesting not to settle down to simply two operations, the simple and the radical mastoid, as some seem to do. He thought that Dr. Kopetzky would find, if he was guided by the pathology as he said, that if he investigated the aditus and attic first before deciding upon operation and even take off the external attic wall to get a better look at the ossicles, he would save a good many of his patients the radical operation or the prolonged treatment he advocated of leaving the mastoid wound open for a year. He would find that he could ventilate through a large meatus and have the patient well in certainly two months, sometimes three weeks, and have no need of any plastic operation afterwards. Dr. Page said he had operated in this way on three cases since February with a full expectation of having to do a radical subsequently, as the patients had cholesteatoma confined to the antrum and attic. The cases had healed promptly and no subsequent operation had been so far indicated.

DR. DENCH, in closing, said that he had not realized that he had laid down the technique of the mastoid operation so well in the first edition of his book. In describing the technique of the simple mastoid operation in his work in 1895, he insisted on the exposure of the upper and posterior margins of the bony meatus as the first step of the operation. The triangle enclosed between one line lying tangent to the superior border of the meatus, one lying tangent to the posterior border of the meatus, and the curved border of the meatus enclosed between these lines constitute a triangle which he first supposed was the one called MacEwen's Triangle. In looking into the subject more closely, however, he found that the three lines were not those described by MacEwen and consequentiy he has designated this triangle, the "Dench Triangle". Many men who have been his house surgeons will remember that he always spoke of the exposure of the upper and posterior margins of the bony meatus as the important landmark in the simple mastoid operation.

With reference to the introduction of a probe into the antrum, Dr. Dench said that while he was aware that many men laid down the dictum that the probe was not to be used in this way, he thought it advisable to pass a probe from the antrum into the middle ear so as to be certain that the middle ear would be drained as the result of the operation. Bezold many years ago had taught that the mucous membrane of the aditus ad antrum should not be disturbed. He did not agree with this, but always enlarged the aditus so as to clear out all granulation tissue. There was no danger of injuring the facial nerve if the cutting edge of the curette was directed upward.

Dr. Dench also approved of what Dr. Maybaum said about evisceration of all cells, and called attention to the group of cells lying just in front of the knee of the lateral sinus between the sinus and aditus ad antrum. These cells are usually present, but are sometimes shut off from the remainder of the mastoid by a firm layer of bone. If these cells are not obliterated, recurrence is apt to take place. Dr. Maybaum's exhibition of the operation was most excellent, but he did not lay enough stress on the removal of the tip. This should be removed in every case of acute mastoiditis. As to drainage and the use of a cigarette drain, Dr. Dench said that he used to be in favor of packing the mastoid very firmly, but he had discarded this method, and now used instead of a cigarette drain, a piece of folded rubber tissue carried into the antrum. In uncomplicated cases, this is the only drain necessary. The wound is then closed by

using a buried catgut suture to appose the soft tissues for about three-quarters of the length of the wound, the drain being brought out at the lower angle of the wound. The soft tissue is then closed for the same distance with Michel clips. Dr. C. R. Holmes, in 1912, first emphasized the necessity of closing the soft tissues and called it suture of the periosteum. For a fact Dr. Dench said that when the periosteum was stripped from the surface of the mastoid, that it retracted so that it was almost impossible to appose the cut edges. If the soft tissues were apposed in the manner described, including the periosteum as much as possible, healing would be much more rapid and the same result would be obtained as if the periosteum were apposed. Healing is much quicker after closing the wound in this manner and there is very little deformity.

With reference to the functional result after the radical operation, Dr. Dench said that in a paper read before the Otological Congress at Paris in 1922, he stated that in only 1 per cent of the cases operated upon was the hearing made worse. It may be said in general that if the hearing is very good in the case operated upon, it will probably be somewhat impaired after operation. If, however, it is very poor, the hearing will probably be improved, provided the cause of impairment of hearing lies in the conducting mechanism alone. If the hearing is moderate, it will probably remain unchanged after the operation. The statistics in the Transactions of the Tenth International Otological Congress in Paris prove this conclusively.

Dr. Dench said that Dr. Smith emphasized the question of landmarks again, and had particularly emphasized the Dench triangle. This landmark is exceedingly easy to expose and invariably lies over the aditus ad antrum. Dr. Smith spoke of using rongeurs, by anchoring one blade and then shaving away the bone with the other. This technique is excellent and Dr. Dench has used it with a great deal of success. The remarks made about using the curette along the course of important structures rather than at right angles to them was also a favorable point and had been long employed by Dr. Dench. Dr. Dench had already mentioned the use of the rubber tissue as a drain, and believes it the best substance with which to drain after operation. Dr. Dench did not, however, agree with what Dr. Smith said about the course of the facial nerve. In some instances he had seen the facial nerve run under the floor of the external auditory canal and had exposed it in this region in two or three cases.

As to seeing the stapes, Dr. Dench said that he never felt that a radical operation was complete unless he could see the stapes, if present. If the stapes had been destroyed by disease, one could then see very clearly the oval window. With reference to injuries of the lateral sinus, he emphasized the importance of inserting a packing over the sinus between the dura and skull, thus pressing the walls of the sinus together and causing obliteration of the vessel. This method is much more effective than plugging the lumen of the sinus. He had never seen a brain abscess occur as the result of packing over the sinus.

Referring to what Dr. Davis said about the blood clot and the radical operation, Dr. Dench called attention to the fact that the blood clot healing occurred only in closed cavities. He would be very glad to see any case of radical operation in which dermatization of the operative cavity had occurred in four weeks, as the result of allowing the cavity to fill with blood.

As to what Dr. Page had said about cholesteatoma in the anterior part fo the cavity, Dr. Dench said that he had very seldom seen any cholesteatomous deposit on the anterior part of the cavity. It never occurs here unless the tubal cells are exceedingly well developed. Cholesteatoma is almost always confined to the upper and posterior part of the tympanomastoid cavity. At a meeting of the New York Otological Society he had called attention to the fact that English surgeons seldom graft in cases of cholesteatoma, for the reason that the mere fact that cholesteatoma is present, causes the cavity to dermatize rapidly with little interference on the part of the operator.

SECTION ON LARYNGOLOGY AND RHINOLOGY.

October 22, 1924.

ENDOSCOPIC SYMPOSIUM.

a. *Endoscopic Methods as Aids to Diagnosis in Diseases of the Upper Airways and Esophagus.* Dr. Hubert Arrowsmith.

DISCUSSION.

DR. FREUDENTHAL said he wanted to thank Dr. Arrowsmith for his interesting paper and wished to make only one remark regarding the intrabronchial treatment of asthma; he had tried it repeatedly and would like the men present to try it again. There is no method by which one could succeed in all cases of asthma. In his hands this method has given good results in a comparatively large number of cases, and even in those where others had failed.

DR. IMPERATORI said that one phase of treatment seemed not to have been mentioned and that was the use of radium in cases of carcinoma of the larynx, bronchus and esophagus. He did not believe that there were any cases of a cure on record. However, cases of inoperable carcinomas of the larynx and esophagus seemed to be materially benefitted; in particular, lessening the pain and prolonging life.

DR. ARROWSMITH said he had tried Dr. Freudenthal's method and liked it very much.

b. *Foreign Bodies in the Upper Airway and Esophagus.* ..*Dr. C. J. Imperatori*, Dr. Dever S. Byard, Dr. Willis F. Manges.

DR. C. J. IMPERATORI: In a general consideration of foreign bodies that may enter and become lodged in the upper air passages and esophagus, it is well to remember that they may enter by way of the mouth or they may be regurgitated from the stomach; or, having entered the chest cavity and gained entrance to the lung, they may be coughed up to a place of lodgment. It should also be remembered that in certain diseases masses of necrotic tissue or part of a new growth itself may in the process of ejection become lodged in the passages and thus assume the role of a foreign body.

The usual site of lodgment of a foreign body in the airways, provided its size is such that it may get beyond the glottis, is the right bronchus.

In the esophagus most of the foreign bodies will be found in the region of the cricopharyngeus. In the adult this is approximately 16 c.m. from the upper teeth and opposite the sixth cervical vertebra, while in a child this distance from the upper teeth is but 9 c.m., and the location is opposite the fourth cervical vertebra.

The reasons for these particular sites of lodgment are anatomical. In the airway the right bronchus is more of a direct continuation of the trachea than the left, and it is much larger in diameter, the trachea being 24 m.m., the right bronchus is 23 m.m., while the left is 20 m.m.

In the esophagus, the cricopharyngeus area is crescentic in outline and projects forward with the concavity anteriorly. The lower part of the larynx is directly in front, thus making the greatest diameter of the esophagus, at this point, in the coronal plane. A foreign body is thus very likely to become lodged here because of the contracted anteroposterior diameter; and, secondly, the cricopharyngeus muscle will hold the foreign body.

However, it must be understood that no hard and fast rule as regards the site of lodgment can be given with absolute precision.

Great assistance is given by the radiograph both as to the size, shape and nature of the foreign body. By the X-ray we also determine the location of the foreign body and its relation to other structures. When we encounter the non-radiopaque foreign body we have a somewhat different problem to solve, and the assistance of one accustomed to the study of this condition becomes of vital importance.

Assisted by the stereo-radiograph, and ascertaining the amount of flattening of the diaphragm, the recognition of an over-aerated lung and the

displacement of the heart combined with a previous fluroscopic study, requires the expert and highly specialized skill of a radiographer accustomed to interpret these findings.

Usually very material assistance is given by the radiographer, even in the presence of a non-radiopaque foreign body. Of course, in all of these cases in the event that no material assistance is given by the X-ray and there is the history of the possible lodgment of a foreign body in either the air passages or esophagus, endoscopy is indicated and usually with conclusive findings.

In the peripherally located foreign body in the airways, after ascertaining the location, the removal is assisted by the biplane fluroscope and makes a success of what must necessarily otherwise be a failure.

The patient's history is of major importance and should be given due consideration.

There may be considered two types of foreign body history: One in which a patient gives a regular history of the swallowing or inhalation of a foreign body; and the other type of history in which there is a sudden onset of symptoms indicative of the entrance of a foreign body, but with no definite history of the cause. Of course in infants and young children frequently there will be no history whatsoever.

Methods of removal of these various foreign bodies are each one a problem that has to be worked out for each individual case.

Some general rules that may not be amiss in stating are:

1. Past experience.

2. Axis traction, a term suggested by that master broncho expert, Chevalier Jackson.

Without the proper understanding of axis traction, force becomes necessary and danger immediately threatens.

By axis traction is meant traction exerted in lines parallel to the long axis of the tube—be it bronchus or esophagus that the foreign body is being extracted from.

3. Gentleness in the manipulation.

4. Determination of success with due regard for the patient and the parts under manipulation, and remembering that force may remove the foreign body but the patient may succumb to the after effects of the operation. It is better to desist, if unsuccessful after a certain time of manipulation, and try again at some future date. The foreign body in itself is rarely fatal. The peanut being the exception to this statement.

The instruments used are of great importance, and in my opinion the Jackson type of distally illuminated bronchoscope and esophagoscope and the Jackson type of forceps are more easy of finer and gentle manipulation than the Bruening or Kapler type of instruments.

Results may be measured by the skill and experience of the operator. With proper study of the case in hand, expertness in the use of the necessary instruments and a previous practical demonstration on the manikin, the average foreign body should be removed in nearly 100 per cent of instances.

In peripherally located foreign bodies, non-radiopaque foreign bodies and vegetable foreign bodies in which great expertness is required—success will not be so positive.

These are a few of the problems encountered in this phase of endoscopic procedure—that is, the removal of a foreign body from the airways and esophagus. Several important topics and methods of diagnosis and procedure have been touched upon, and it is hoped sufficiently so to induce a discussion.

DR. DEVER S. BYARD: I wish to offer a brief summary of one hundred cases of foreign body retention. The subjects are of usual age incidence.

1. Age of subject: 1, 10 months; 29, 1 to 4 years; 57, 4 to 6 years; 10, 7 years; 3, 8 years.

2. The foreign body was located: 11, digestive tract; 89, respiratory tract.

3. Site: The site was revealed by: autopsy, 11 cases; endoscopy, 20 cases; X-ray, 69 cases. The cases included were selected because each had a history of diagnostic significance. They are furnished by—reports —two child-caring institutions, New York City (courtesy of their records for this purpose only), and St. Mary's Free Hospital for Children in New York City.

4. Material of survey: St. Mary's Hospital for Children, 20; institutional records, New York City, 35; literature, 1915-24, 45.

5. History: Foreign body incident was noted in 38 histories. Undiagnosed group, 18 subjects; diagnosed group, 20 subjects. Incident suggestive of foreign body incident was recorded in 17 histories. Diagnosed group, 7 subjects; undiagnosed group, 10 subjects. Foreign body incident or incident suggestive of foreign body or diagnostic symptoms noted in 94 histories. Suggestive symptoms warranting foreign body suspicion, 6 histories.

6. Diagnosis: Diagnoses from history, expected, 94 cases; diagnoses from history, possible, 100 cases. Diagnosis clinically made by internists, 70 cases. Diagnosis of foreign body by first observer made in 24 cases; res. tr., 21; al. tr., 3. Observation period: 1-17 days, average 9 days. Undiagnosed foreign body, first observer, 65 cases. Diagnosis of foreign body, ultimately made, 65 cases; res. tr., 58; al. tr., 7. Observation period: 14 days to 1 year, average 4 months. Later observers, 38 cases. Consultants, 8 cases. Routine hospital X-rays, 13 cases. Subject expulsion of foreign body, 6 cases. Diagnosis by autopsy, 11 cases. Incorrect diagnoses, first observer included: Tuberculosis, 20 cases; whooping cough, 20 cases; croup, 10 cases; diphtheria, 8 cases.

7. Fatalities: Early diagnoses by first observer, 24 cases (5 subjects). Undiagnosed (autopsy), 11 cases (11 subjects). Late diagnosed, 65 cases (20 subjects).

The individual practitioner but rarely observes the condition of foreign body retention. His personal experience therefore would afford a small clinical offering. In the place of such discussion, I have presented these statistics, which in a small way emphasize some particulars of our failures. They are significant of the critical and unshared responsibility of the clinician first consulted—the pediatrist—practitioner.

In expectation of result—in damage or death of subject, the importance of the interval between the foreign body accident and the operative incident of its removal is confirmed. Most histories furnish a parent or subject recital of actual foreign body accident: very few lack group symptoms, characteristic of irritation or obstruction. We cannot escape the evidence of the foregoing records that most failures of diagnosis are attributable to an inadequately considered history. Further, they offer implications of our mental state of unawareness.

For the suspected or diagnosed condition of foreign body retention Dr. Imperatori has achieved an admirable survey. To the internist it will be particularly acceptable in that it discloses both the endoscopist's average expectations and his discriminations as to technical procedures.

Dr. William F. Manges: It is a pleasure to come to New York and talk upon this subject of foreign bodies, which is one very near and dear to my heart, as a roentgenologist. I have had the rare opportunity and privilege of working with Dr. Jackson for some years, and so have perhaps had more opportunity to study foreign bodies from the point of X-ray diagnosis than most any other roentgenologist in the country, if not in the world. I feel that I owe the medical profession a great deal that I have not as yet delivered. Many others in my position might have done a great deal more for children and for the rest of the medical profession, but I have brought a few slides to show, and will try to demonstrate what we have done by means of the X-rays in the diagnosis of foreign bodies, and what help we are trying to give in the removal of peripherally-seated foreign bodies in the air passages.

My own feeling is that the most important step in the diagnosis of foreign body is the history. I may go further and say that if there is even the suggestion of a history of the aspiration of a foreign body by an

infant or child, the diagnosis is positive for foreign body unless you prove that it is negative—and that includes observation over a period of weeks and months, necessarily so, because with the aspiration of a large percentage of foreign bodies there is a period of calm during which there are few or no symptoms or signs, occasionally cough, perhaps a little restlessness, perhaps nothing more than that; so that when there is a history of aspiration or a history of coughing while having some foreign substance in the mouth, the diagnosis is positive until you prove it negative. You can prove the negative phase of a metallic foreign body by the roentgenogram, and I will show you that it can be made as nearly positive or nearly negative when the foreign body is not opaque to the X-ray. Judging from the pathology as shown by the roentgenogram, my belief is that the physical sins are most nearly characteristic when they vary very much more than they do in any other known chest condition. I am not qualified to discuss physical signs.

Now, I will show some slides and will try to demonstrate four distinct types of pathological change demonstrable by the X-ray that may take place in the lungs in these foreign body cases. The first is Obstructive Emphysema; second, Retained Secretions or Drowned Lung; third, Atelectasis; fourth, Lung Abscess.

Obstructive emphysema occurs when a foreign body lodges in a bronchus, produces a local inflammatory reaction, and mechanically causes obstruction to expiration, so that when the bronchus expands at inspiration, air gets past the foreign body into the lung, but when the bronchus contracts at expiration, the air does not get out readily, so that there is overdistention with air distal to the foreign body. This may involve a portion of a lobe, one lobe, one entire lung, or even both lungs, according to the location of the foreign body—that is, when it is in the trachea, it will produce obstructive emphysema of both lungs, when in a main bronchus, obstructive emphysema of one lung, and so on according to the location.

Retained secretions are secretions that form distal to the foreign body and that gradually go by gravity into the air vesicles of the lung. The shadow is one of increased density but without evidence of cavity or tissue destruction. Such secretions can mostly be aspirated after removal of the foreign body.

Atelectasis follows when a foreign body is of such size and shape and in such position as to produce complete obstruction to inspiration. The air present in the lung distal to the foreign body prior to complete obstruction becomes absorbed and the lung collapses; and again, a portion of a lobe, an entire lobe, or one lung may be involved. A foreign body producing this type of obstruction would naturally be promptly fatal if it were lodged under such conditions in the trachea.

Abscess is the inevitable result of foreign body sooner or later if the foreign body is not removed. It follows the lodgment of vegetal foreign bodies more quickly than metallic foreign bodies. It is most frequently found in the lower lobes and there is extreme density in the shadows with destruction of lung tissue detail and evidence of inflammatory reaction in the adjacent lung tissue.

The first slide is of a case of obstructive emphysema of the right lung due to peanut kernel in the right bronchus. This boy was able to take a full breath and hold it when I asked him, and also to exhale and stop at the right moment, so that these are illustrations of extreme inspiration and extreme expiration. You will see that the right lung retains its air throughout the entire respiratory cycle, while the left lung empties most of its air at expiration. The heart displaces markedly to the left at expiration and the left diaphragm is very much higher than the right. After removal of the foreign body, full inspiration and full expiration show normal relations throughout the respiratory cycle.

The next slide is one of a peanut kernel in the left bronchus, showing obstructive emphysema of the left lung. The signs are exactly as in the former case only they are reversed as to right and left.

You will notice that at full inspiration the chest in both of these cases has very nearly normal appearance and it would be impossible to make a diagnosis from exposures made only at inspiration. It is the difference between inspiration and expiration that tells the story. Sometimes the obstruction is quite marked and again it is not so nearly complete and the evidence of obstructive emphysema varies somewhat also.

The next slide is of a case in which the reaction was not so striking, but it is positive on careful comparison. From this case, Dr. Jackson removed a portion of a peanut kernel. The following day, the signs were still present, and on subsequent days they became even more positive. The next slide shows that there was extreme expiratory obstruction of the right bronchus about a week after the removal of the first portion of the foreign body. At this time Dr. Jackson removed a second portion of peanut kernel, and the child coughed up a third fragment on its way from the operating room to the ward. After this, the picture at expiration was normal.

Retained secretions is a stage of foreign body pathology that either does not develop or is of but short existence, and, when found, the picture changes from day to day, merging into either a stage of atelectasis or of abscess formation. This next slide shows a striking example of compensatory function of the right lung, with retained secretions in the lower left lobe, obscuring the diaphragm shadow, while the picture at expiration shows clearly that the left upper lobe does not empty its air, so that there is evidence of retained secretions in the lower lobe and obstructive emphysema of the upper lobe on the left side—the foreign body being necessarily in the left main bronchus. After removal in this case there was a certain amount of inflammatory reaction throughout the left lower lobe, but this cleared up rapidly and the child made a complete recovery.

The next slide is of a case in which there was much discussion as to the presence of a foreign body. The history was not positive and the physical signs were very unusual. When I first examined the child on the twenty-third of the month, there was evidence of consolidation in the left upper lobe and at the fluoroscope I felt that there was limitation of motion of the left diaphragm, with retained air at expiration. These exposures as shown by the slides do not represent full inspiration and full expiration. The child was ill and the respirations were very shallow, but at the fluoroscope, while the child was crying, it was evident that there was obstructive emphysema of the left lower lobe. I insisted that the consolidation in the left upper lobe was a pneumonic process that had nothing to do with the foreign body, but that there was probably a nonopaque foreign body in the left lower lobe bronchus. On the twenty-seventh, the pneumonic consolidation had cleared up entirely and the left upper lobe functioned normally. The evidence of obstructive emphysema in the left lower lobe is a little more pronounced than at the former examination. Following this, Dr. Jackson passed a bronchoscope but failed to find a foreign body. Following the first bronchoscopy, the signs of obstructive emphysema of the left lower lobe became still more positive and the Roentgen ray diagnosis also became more positive for foreign body. At the next bronchoscopic examination, Dr. Jackson removed a portion of a peanut kernel, and you will notice that the exposures made at inspiration and expiration, after removal of the foreign body, show an entirely different air picture of the left lower lobe than those taken before removal.

The next slide illustrates a case in which a peanut kernel lodged in the trachea and was of sufficient size so that, together with the edematous inflammatory reaction of the mucous membrane, it caused partial obstruction to expiration. You will note that both sides of the diaphragms are depressed. The heart stands out clear above it and is more vertical than it should be. The exposure made after removal of the foreign body again shows normal relation.

Atelectasis follows complete obstruction to inspiration. In this illustration, the foreign body is a metallic object and its shadow is readily recognizable.

In the next slide, the foreign body is a bean and one does not see the shadow of the foreign body, but it is very evident that the entire right lung is collapsed and contains no air except perhaps a little in the extreme apex of the upper lobe. The heart follows the contracting lung into the right side of the chest. The right main bronchus is completely obstructed to inspiration, and with a history of sudden onset and in the presence of acute illness, one must admit that this constitutes a positive diagnosis of foreign body. All bean cases that I have been able to trace have produced just this condition, and it is because when the bean gets in a bronchus and lodges, it takes up moisture and increases in size, so that obstruction soon becomes complete. You will notice in the next illustration that within a few hours after removal of the bean, the entire right lung is again functioning.

The next slide shows a case in which there was atelectasis of the right lower lobe. There was a history of aspiration of foreign body and a bronchoscopic examination was made under ether, but no foreign body found. In spite of this, the diagnosis of foreign body is positive because of the presence of atelectasis of the lower lobe. Three days later there was an entirely different set of conditions in the right chest. You will notice that now the right diaphragm is very clearly shown; the lower lobe as well as the middle lobe is fully distended with air—in fact, at expiration they are shown to be greatly overdistended with air, so that there is now obstructive emphysema involving both the lower lobe and the middle lobe, and at the same time you will see by the density and the small size of it that there is atelectasis of the right upper lobe. The foreign body shifted from the lower lobe bronchus into the right upper lobe bronchus, where it produced complete obstruction to inspiration, and at the same time projected sufficiently far into the stem bronchus to produce obstruction to expiration and consequently obstructive emphysema below it. The next slide shows the same case after removal of the foreign body when all parts of the right lung, as well as the left, show normal function.

The next slide is of a case in which abscess followed the lodgment of a fragment of corn stalk. It has the general appearance of lung abscess of some standing, regardless of the cause. The diagnosis is not positive for foreign body but lung abscess in this particular location is, in the vast majority of instances, due to aspiration of some foreign substance.

And now a few words about the double-plane fluoroscope apparatus and its use in connection with the removal of foreign bodies. From the photograph of the apparatus, you will see that one X-ray tube is placed beneath the table and the second X-ray tube is mounted at the side of the table. Both are inclosed in the transformer case, so that there are no high voltage electric wires exposed and one may touch any part of the apparatus without getting an electric shock. One has the usual diaphragm opening that may be made large or small and also a control to increase or lessen the amount of current. The patient lies on a sort of platform that is very much narrower than the top of the table and rests on crosspieces so that one may slide it in any direction. The two tubes are so placed as to be in the same cross-section plane, and the central ray is made to pass vertically through the foreign body from the tube beneath the table and horizontally through the foreign body from the tube at the side of the table. The current is controlled by means of foot-switches. The fluoroscope is one of convenient size and is held in the hands of the roentgenologist. I used to use two screens hinged so that one was on top of the patient and one at the side, but I found this rather cumbersome, especially in small children, and I am not using a single screen, 8x10 in size.

The next slide illustrates what we see in the fluoroscope. In this case a bullet entered by violence from the back and was not aspirated. It was not in a bronchus but you will see from the pictures made with the

bronchoscope and forceps in place that the forceps were in very close relation to the bullet, both in the vertical plane and in the horizontal plane. In this case Dr. Jackson went still further and injected bismuth subcarbonate into the bronchus where the forceps had been and established the relations of this bronchus and its branches to the foreign body. It was found, on consulting a cross-section anatomical chart, that this particular bronchial branch might be penetrated without risk of damaging any important blood vessel, and at the next operation, Dr. Jackson penetrated this bronchus, grasped the bullet, and removed it through the bronchoscope. There was no reaction or untoward symptom following the operation.

The next slide shows another type of foreign body which was particularly mentioned by Dr. Imperatori—that is, the pin. It is probably the most difficult of all foreign bodies to remove, and also the most dangerous. It is necessary to protect the point by means of the forceps or tube. It is extremely difficult to see the shadow of the point if it projects less than an eighth of an inch beyond one side of the forceps, and all of the attention and concentration of the roentgenologist, as well as of the bronchoscopist, is required to make traction a safe procedure. The roentgenologist should be sure to get his eyes in the best possible state for viewing delicate shadows, and he should go to much greater length to get his eyes sensitive to a little light than he would for any other sort of fluoroscopy, and he should be especialy careful not to look directly at the light at the end of the bronchoscope. It is apt to produce dark spots in one's vision that may remain for a considerable length of time. The next and perhaps the most important thing is for roentgenologist to make sure that he actually sees the foreign body shadow. He can easily be the cause of a great deal of harm if he mistakes some other shadow for that of a foreign body. It would be much better for the bronchoscopist to go independently in search of the foreign body than to be misguided by the roentgenologist. We just had a case to illustrate this that came from the extreme opposite side of the world. There was a history of aspiration of a button. He was sent with an X-ray diagnosis of foreign body. The evidence in the X-ray was a dense shadow more in the anterior and outer portion of the right lower lobe in an otherwise perfectly normal lung field. It was more or less crescentic in shape, as if it might be a half of a button, but it was considerably thicker than any button that I know anything about. There was pathology in the right lower quadrant—that is, the right lower inner posterior portion of the lower lobe—in the location where foreign bodies usually are found, but in this location there was no distinguishable foreign body shadow. At the first operation, Dr. Jackson was in close relation to the calcareous shadow with his forceps, but found that it was necessary to penetrate a bronchus in order to grasp the object which we saw, and he declined of course to do this. Some days later, when Dr. Jackson decided upon a second bronchoscopic effort, I suggested that he investigate the posterior branches of the right lower lobe bronchus and disregard the calcareous shadow which was entirely outside of the field of active pathology. The results of his efforts was that he brought out half a small pearl button, together with a lot of granulation tissue and much purulent exudate. We had not seen the shadow of the button at all. Following removal of the foreign body, the original calcareous shadow still remained, and I am certain that it is not an aspirated foreign body.

Bronchoscopy in the Treatment of Lung Abscess. Dr. Sidney Yankauer.

Until about ten years ago the treatment of lung abscess consisted entirely of medical and hygienic treatment, but about that time, for two reasons, we began to see more lung abscesses than we had ever seen before. One reason was that more tonsillectomies were being done, and the other reason was that in the various tuberculosis sanitariums they had learned to differentiate between tuberculosis and lung abscess, and had begun to refuse accepting lung abscess cases.

At that time, these lung abscess cases presented a problem not solved by the ordinary methods, even though the specialists were not behind in

their attempts. Cases were treated by spray, by various kinds of vapors and inhalations, by intratracheal medication and by bronchoscopy and aspiration. But these methods of treatment were not successful. The chief reason for their failure was that in attempting to inject medication into a lung, the volume of fluid contained within the chest was increased and therefore fluid occupied bronchi which it did not occupy before. The result was that whatever benefit was obtained by medication was more than overbalanced by the increase in the area involved in the disease. Now the fluid which is contained in the bronchi in the lung abscess cases is a very viscous fluid which adheres firmly to the walls of the bronchi. The viscosity is so high that it is impossible to remove the secretion with the very fine tubes which it is necessary to use to get into the bronchi (we must use tubes 3 m.m. diameter inside and 4 m.m. on the outside), even with the most powerful suction apparatus we have.

The problem presenting itself to me in considering this subject was how to diminish the viscosity and the adhesiveness of the secretions without increasing the volume. This was solved by the construction of a double irrigating canula, through one of whose channels the diluting fluid was injected while the diluted fluid was at the same time aspirated through the other. Since the invention of this method, the treatment of lung suppurations in the hands of the bronchoscopist has been successful. I speak not only for myself but also for the others who have visited the clinic at Mt. Sinai Hospital, who have seen the work we are doing, and have followed the methods. Some of these bronchoscopists have become even more enthusiastic than I am and have reported even better results than mine, and have been notably prolific in devising modifications and improvements of my original apparatus, according to their own individual needs. The results that I have obtained in lung suppuration of various kinds have been as follows:

We have examined bronchoscopically about four hundred cases. Of these only seventy-one came into our hands for endoscopic treatment. These seventy-one cases have been repeatedly treated by simultaneous irrigation and aspiration. The total number of treatments amounts to nearly 3,000. Of the seventy-one cases, eleven cases, 15 per cent, were cured; 15 per cent were unimproved; 50 per cent were improved, and in deciding what sort of cases should be called improved or unimproved, we took as our criterion the ability of the patient to go about his business and to attend to his daily task. Those cases in which amount of secretion was so far diminished that they were able to go back to work and come into the hospital once a week, or once a month for treatment, were considered improved. The cases which could not do this we called unimproved.

A number of the cases went to operation—10 per cent. A number of the cases, about 10 per cent, were unaccounted for.

The greatest difficulty in initiating this method of treatment was to gain the confidence of the general practitioner, who feared danger in the procedure because the cases were sometimes subjected to reaction following bronchoscopy, and this reaction was at times quite severe (rise in temperature for twenty-four hours). Altogether, eight of the cases died, four of these were operated upon and the deaths were postoperative. One of the cases had a myocarditis. She was treated a number of times, in spite of the fact that she could not stand the treatment very well. She gradually weakened and died. Another of the cases was kept under treatment for a year with apparent improvement, but at the end of a year, during an influenza epidemic, became ill with pneumonia and died. Two of the cases died soon after bronchoscopy, due to the reaction; one had a chill and rise intemperature and died in twenty-four hours. The other remained alive for five days when with a rise in temperature she developed pneumothorax and died. These two were the only deaths attributable to the bronchoscopy, and this is the measure of mortality in endoscopic treatment in lung abscess—two cases in 3,000 treatments.

In bronchoscoping a patient for lung abscess, the first bronchoscopy is always a diagnostic one, and the following are the treatments. The

diagnosing bronchoscopy is of the utmost importance. In the first place, we must diagnose the presence of a lung abscess and eliminate other conditions, and in the second place, we must diagnose the nature and character of the abscess itself. The lung abscess must be differentiated in the first place from abscess due to the presence of a foreign body. Foreign bodies of metallic origin are always found by the X-ray. The foreign bodies which do not show by X-ray are another story. In chronic cases they do not give the valve action described by Dr. Manges this evening.

The first case of lung abscess that I bronchoscoped was a patient who denied having inhaled a foreign body, but a chicken bone was removed from his bronchus. A number of other foreign bodies have been found in lung abscess cases, one of the most interesting of these being a patient supposed to have a post-tonsillectomy lung abscess. We found a piece of bone in the abscess cavity which the patient denied having inhaled, but it was later discovered that at the time of tonsillectomy, which was done under general anesthesia, one of the turbinates was removed and on examination of the foreign body we found that it corresponded quite well with the shape and contour of the turbinate bone.

It is important to eliminate in every case, the presence of a foreign body as a cause of lung abscess before attempting to operate upon this condition. Failure to find a foreign body which is the cause of the abscess is rare, and even though it is possible, this fact does not interfere with the statement that every lung abscess case should be bronchoscoped before surgical interference is attempted.

Quite a number of our cases have turned out to be malignant. The examination of our record shows that most of the patients who begin to have symptoms of lung abscess after the age of forty, have a malignant growth even if it is not demonstrable. Benign growths have been found and in both removed endoscopically and the lung abscess eventually cured.

Extra-bronchial growths have been recognized in a number of cases. It is not possible, of course, for the bronchoscopist to make a diagnosis of the nature of the extra-bronchial growth unless it happens that the location of the pressure upon the bronchus is suggestive of a diagnosis. We may find bronchiectasis unilateral or bilateral. When bilateral, operative procedure at the present time is of questionable value.

Having established the presence of a lung abscess, the next thing to be noted is the extent of the suppurating area of the lung. This may be ascertained by bronchoscopy for it tells us from which branches the pus is coming. In this way we can also say with certainty in which lobe the abscess is located. This is particularly of value in distinguishing between an abscess in the middle lobe and one in the upper part of the lower lobe, these two areas being superimposed in the X-ray plate. In like manner, if the abscess is located near the hilus, it is difficult to distinguish by radiography in which lobe it lies, but the bronchoscopy tells us with certainty.

Having determined these features of the diagnosis, we come to the treatment of the cases. In some cases we find at the first treatment that we suddenly get an evacuation of a large quantity of fluid from one of the bronchi. Following such an occurrence there is likely to be a rapid improvement of the condition of the patient, and a cure is accomplished after two or three bronchoscopies. In the cases that we have cured in this way there was probably not a true lung abscess, but a condition which might be characteried as a chronic localized suppurative bronchitis. The rapidity and completeness with which such patients recover from their condition after one or two or three bronchoscopic treatments is one of the most dramatic and surprising things about endoscopic treatment of this condition.

It is quite possible that such a localized suppurative bronchitis may give an X-ray picture showing a fluid level because the pus lies in the same level in all of the bronchi and their superimposed shadows give

rise to this appearance whether the picture is taken in the upright or in the recumbent posture.

On the other hand, a true lung abscess is not present unless ulceration of the bronchi has taken place and pathological communication has been established between them so that there is actual destruction of tissue. When such a well developed abscess has been formed the cavity is surrounded by an area of consolidation. In these cases the bronchoscopic treatment is not so simple nor does a cure result in such few treatments. We may treat such a case by an attempt to evacuate the abscess cavity. For this purpose the canula with a flexible end, devised by Dr. Lynah and which has been combined with a specially constructed bronchoscope by Dr. Lukens, is an admirable device. Previous to Dr. Lynah's invention I had been using a metallic canula to the end of which a flexible wire was attached and the whole covered with a rubber tube. That served the purpose well enough but was not as elegant an apparatus as Dr. Lynah's.

In these cases, the disease is not in the cavity itself, but in the pneumonia surrounding it, and we must attack the disease by attacking the periabscessal pneumonitis. This is accomplished by irrigating each bronchus from which pus is seen to come and to continue irrigation until the lung is clean. In this way the periabscessal pneumonitis is diminished, the abscess wall has a chance to shrink, and the cavity to close.

If we follow these cases with the X-ray, we will find that in the early cases in which the abscess wall is soft the cavity collapses, the infiltration disappears and the X-ray shadow disappears completely, but in the older cases in which the abscess wall is already composed of organized fibrous tissue, the X-ray shadow will not completely disappear but a small shadow will remain at the site of the abscess cavity, indicating the presence of a scar in the lung. One of my cases, a post-tonsillectomy abscess of one year's duration, was cured after eight months of irrigation; the last irrigation was performed in 1917—the patient has been continuously well as far as her lung is concerned during this time, in spite of the fact that the radiograph still shows the presence of the scar in the lung. This patient has been anesthetized twice during this time without disturbing this scar.

Finally, I would like to say a word about the most effective treatment that we know of, the prophylactic treatment. Fully 25 per cent of lung abscess cases are due to tonsillectomy in adults under general anesthesia. If we performed our tonsillectomies in adults under local anesthesia, these abscesses could, with very rare exceptions, be prevented.

The Diagnosis and Treatment of Lung Abscess. Dr. Harlow Brooks.

Lung abscess as it now occurs is a much more frequent condition than it has been in the past. But a few years ago it was a quite rare and unusual condition to find in our wards, whereas, it is now among the rather frequent of the unusual lung conditions which we are called upon to treat.

Naturally, with increase in frequency, has arrived a much more universal ability in diagnosis, so that I think it is rather unusual that the condition is not recognized, or at least considered when it now appears on our medical services. The undoubted increased occurrence is somewhat difficult to explain unless it be because of the increased frequency of those types of infection which most commonly cause lung abscess.

It is generally accepted that many lung abscesses are a secondary result of tonsil operations. This does not, however, account in the least for the increased occurrences in lung abscess in this locality which develops in persons who have had no operation on the tonsils, and this increase is also an undoubted fact.

I shall try to restrict my remarks entirely to the subject assigned for the evening, and I shall, therefore, limit myself to a discussion of the types of lung abscess which follow tonsilar operations. Briefly, they may follow from a bronchial infection, due, perhaps to infected material aspirated at the time of operation. They may also be caused by venous or arterial thrombosis, more probably through the latter, the abscess developing from infected material swept into the veins from the operative site.

Another possibility to which I wish to call attention is that of a local infection developing in the lung from the liberation of organisms or toxines in the course of the operation, just as for example exercitation of an arthritis or endocarditis may appear when an infected tonsil is removed from which a previous arthritis or endocarditis may have developed. Certainly the condition is of sufficiently frequent occurrence in the course of tonsillectomies as they are now performed to cause the internist to stop and consider when he feels that because of their infected condition the tonsils should be removed.

Diagnosis: The diagnosis of lung abscess, such as occurs after tonsillectomy, is not ordinarily difficult. Cough is one of the earliest and most frequent symptoms. It is usually of a dry, persistent and nonproductive type, and it commonly occurs in paroxysms. Not at all infrequently the paroxysmal type of the cough excites a question as to whooping cough, and the differentiation before lung signs appear is not always easy. Later on the cough becomes productive, and the paroxysms appear chiefly in the morning after night's rest in the dorsal position. It becomes finally loose and easy after the abscess has broken into the bronchus and the end of the paroxysm is accomplished with the expectoration of sputum, depending in amount on the size of the cavity and its freedom of drainage. It is notable after drainage through this channel has taken place that after the cavity has been emptied cough subsides. After a greater or lesser period of time another paroxysm follows, terminating again with the evacuation of the abscess contents.

At first the sputum is very scanty and mucoid in nature, later on it becomes more and more purulent. Fetor is present in only a relatively small number of early lung abscesses which develop from tonsilar infection, but it sometimes becomes eventually very marked, quite as much so as when the abscess has developed from empyema, or from a purulent bronchitis or bronchiectasis. Blood is frequently present in the sputum. Elastic fibrils are rarely found and are in small numbers when present. Necrotic material is not very abundant and the sputum in fully developed cases is chiefly composed of pus in which, of course, is to be found various bacteria, among which are probably present those originally responsible for the abscess formation. Anerobic organisms are often present in those cases with fetor, among them, the bacillus erogenes capsulatus. Of course tubercle bacilli are absent unless the condition is complicated by a tuberculosis.

The physical signs depend chiefly on the size of the involved area, on its location, that is, whether it is near the surface of the lung or deep in the central portions about the great bronchi. In the last case detectable physical signs are often very few and difficult to elicit and recognize. The percussion note may be flattened or high pitched, and when the cavity finally drains freely it will vary accordingly as the cavity is empty or filled, hence before and after coughing. Bronchophony and ergophony may be present, depending mostly on the size of the abscess and on the facility with which it drains. Very frequently the vocal fremitus and the breath sounds are diminished or lost over the involved area, or, as in a localized focus of infiltration they may be augmented and definite blowing breathing may be found. After emptying of a large cavity naturally a tympanitic tone or percussion will be found, or the cracked pot note may appear. Gurgling and bubbling rales appear when the pus in the cavity is of a suitable fluid character. A very interesting sign, sometimes present even in deep seated abscess, is pain and tenderness over the site of the abscess. This may be present even when the focus is small.

Even in small abscesses the physical signs are of a sufficiently unusual nature to usually give justification, in association with the symptoms to a diagnosis of a probable pulmonary abscess or of some other sharply localized infiltratory process, as possibly of a tumor. Fluoroscopic and X-ray examination usually leaves little doubt when the findings are taken in association with the symptoms, physical signs, and in the light of the history of the case. Tuberculosis is rarely suggested by the physical or

ardiographic pictures, though the history of the case may lead one to consider this possibility.

More or less temperature is present, at least up to the time when good drainage is established. Even when the cavity does drain well one is likely to find temperature present when the drainage is least and the pus retention highest, that is, in the morning, while at night no fever is present. The expected septic type of temperature is ordinarily present before drainage is established, but afterwards it may be entirely absent or present. A reversed type as just mentioned.

The same is true of the leucocyte count. It may be high before the abscess begins to drain, but after this it ordinarily varies but little from the normal. A relative polynuclear increase is present when leucocytosis is present, but it is usually of very little diagnostic importance.

As a rule, except in very large abscesses, emaciation does not appear, and the patient may be relatively well and comfortable after he had emptied his cavity and the draining bronchial tubes of pus.

The condition must be differentiated from tumor of the lung, from bronchiectasis, chronic bronchitis with peribronchial infiltration, and at times from a Hodgkin's disease, or other tumor springing from the mediastinal or peribronchial lymph nodes. As I have said, diagnosis is not particularly difficult in most instances, and where a confirmatory bronchiescopy is possible it is easy. I strongly advise against diagnostic puncture in diagnosis.

Treatment: Treatment often demands a very wide range of therapeutics. In other instances the case may make a perfectly good recovery with little or no treatment. This depends, of course, very largely on the size of the abscess, on its location, on the character of the infecting organisms and on the natural vigor or resistance of the patient.

Everything must be done to raise the resistance of the patient. Rest, exposure to air and sunlight, a full liberal diet and all the usual measures utilized in the treatment of a resistent bronchitis, or a pulmonary tuberculosis are to be utilized.

Where the condition indicates, iron, arsenic and the other usual measures of treatment may be used. Considerable relief of pain may be furnished by the use of aspirin, salol, atophan and the like, and at the same time the temperature may be thus modified if this seems advisable. Very little relief of cough will be found from the exhibition of the usual cough mixtures, but commonly when the cavity empties the cough ceases, spontaneously.

There is no doubt whatever, but that when satisfactory drainage does not take place automatically it can be often facilitated by coughing in the knee-chest position, or by the patient leaning out of bed with his head lower than the pelvis so that gravity assists in the evacuation of the pus. Where drainage can be readily effected the prognosis is much better, since extension of the abscess through pus retention is not likely to take place. Drainage through bronchial catherization is frequently possible, and I have seen most satisfactory results from the method when it has been conducted by experts in the use of these instruments. Unless this is possible it should not be attempted.

Where it is possible to thus evacuate the abscess no further treatment may be necessary, aside from the maintenance of the health of the patient at its maximum by all the usual measures. A fortunately large number of pulmonary abscesses get well, as it were, automatically, especially when they are not of large size, and the cure once accomplished is ordinarily full and complete. Cure by absorption also takes place with little or no drainage in a probably larger number of cases than we thought possible before we had the advantage of the X-ray in diagnosis. When the case is doing well it is a very wise plan not to meddle too much, and especially not to attempt unnecessary manipulation.

When the abscess is near the lung surface and is likely to rupture into the pleural cavity, thus producing an empyema communicating with the substance of the lung, early surgical assistance seems advisable. A two-stage operation is often done under such circumstances, though of course

this matter of technique should be left to the judgment and discretion of the operator.

Another condition which demands early surgical consultation is when the abscess lies near the hilus and appears likely to rupture into the mediastinal space. These abscesses are particularly difficult of surgical approach, but rupture into the mediastinum is a particularly dangerous thing, and if it can be avoided by surgical intervention it should certainly be attempted.

Where healing fails to take place after drainage has been established several possibilities in the way of treatment present themselves. Where pleural adhesions do not exist the lung may be collapsed down on the cavity, obliterating it more or less by the artificial pneumothorax. The procedure is relatively harmless and it is successful in many instances. More radical measures may, however, be necessary, among which one must consider amputation of a lobe, either directly through surgical means, or by means of the cautery. The cavity may occasionally be widely opened and drained through the thoracic wall.

Lung surgery has made such vast strides of late that one need not hesitate as seemed wise before the surgeons had achieved such notable success in drainage, lobe amputations and with other major operations on the lung. Procrastination should no longer be permitted, and as soon as it seems apparent that no progress is being made under mere medical means, and if drainage and treatment through the bronchoscope is found impractical, one should not wait long before a surgical appeal is made. It is my opinion that the surgeon should be called in consultation relatively early in the case, so that no time may be wasted, once medical measures are found ineffective. Extensive lung destruction may be thus averted, and much time and suffering be saved the patient.

DISCUSSION.

DR. LE WALD: Naturally I will discuss particularly the diagnostic features from the roentgenologist's standpoint; and I will illustrate the procedure by lantern slides and, incidentally, as far as I know it, give the history of a few cases and will briefly state the origin of the abscess and the method of its treatment. The first case is one which, like some that Dr. Brooks has reported, had a spontaneous resolution; the second case had spontaneous cure with the evacuation of a large amount of pus through a bronchus.

The next case is one after tonsillectomy. We had the opportunity to see the case early, and then a little later there was very foul expectoration; and the appearance of a definite circumscribed lesion, but no fluid level could be demonstrated, but on account of the large expectoration of foul material and the previous tonsillectomy we made the diagnosis of lung abscess. It resolved and has gone on to absolute clearing up, not even leaving a fibrous change.

The next case is one in which seven weeks after a radical breast operation, abscess occurred in the lower lobe. That was cured by a two-stage operation. The typical Roentgen signs of lung abscess of course are the localized area of opacity, and, particularly if one can demonstrate it, a fluid level. It is very important to have the fluid level as a diagnostic feature, but it is not always easy to demonstrate it; and if the cavity is entirely filled so that there is no air in it, no fluid level is seen.

In another case the abscess was located in the central portion of the lung. As Dr. Yankauer stated, in these case it is sometimes very difficult to determine the exact site of the abscess. Dr. Brooks did not mention the subject of clubbed fingers, though I know he looks for that. I have found that the clubbing of the fingers and the watch crystal fingernails are very characteristic. I have noticed it constantly and it is not to be overlooked in the differential diagnosis between lung abscess and tuberculosis.

The next slide is to illustrate the value of a lateral radiograph in the localization of the abscess. It is even better than a stereoscopic view.

We have emphasized the necessity of taking direct lateral views in all cases (Le Wald, L. T. and Green, N. W.: Archieves of Surgery, Jan., 1924, Vol. 8, pp. 265-286).

Here is another case which illustrates the presence of fluid level, with the patient sitting up. This is a procedure which should never be omitted.

Here is the type Dr. Yankauer spoke of, the multiple abscess condition. In this case there were five separate cavities which, however, had different fluid levels. These separate cavities made it a difficult case to drain. Dr. Nathan Green operated and some of these cavities were drained, but one residual cavity was left for some time.

The next case shows an enormous lung abscess in a supposed case of tuberculosis. This cavity was drained and the cavity finally ceased to discharge. This is the largest lung abscess cavity which I have seen. It was supposed to be tuberculous, but was not so proven at operation. The boy made a complete recovery after incision and drainage.

The next case is another upper lobe abscess, twenty-one days after tonsillectomy. This is a lateral view after the first-stage operation, in which the abscess region was packed off with iodoform gauze to form adhesions before incising it.

Here is another difficult case to localize—a central abscess. We took lateral exposures in various postures in trying to determine the exact site of the cavity and the best place to go in to drain it. This particular case is cited to show how a wrong X-ray examination is often made in small hospitals by taking patients flat on the back. By so doing you get no fluid level.

The net case shows the differential diagnosis from subphrenic abscess. This case of subphrenic abscess was very carefully examined and almost everyone thought the signs were such that it was diagnosed as a "chest abscess" or collection of fluid in the pleural cavity. How are you going to make a differential diagnosis? By taking *lateral* exposures we were able to demonstrate the diaphragm, showing that the abscess cavity was distinctly below it. However after incision a long probe was passed by the surgeon, expecting that it would enter the abscess cavity, but it did not, and only after incision through the diaphragm was this pus collection evacuated.

In closing, I would say that no patient is too ill to have a differential diagnosis made by changing the posture of the patient in some way in order to shift the supposed fluid level. If you do not wish to have the patient sit up you can do this in bed or on a stretcher by having the X-ray passed from behind forward in such a way as to demonstrate a fluid level, shifting the X-ray tube instéad of the patient.

DR. HOWARD LILIENTHAL said that surgery as well as medicine should be represented in such a discussion as this. Dr. Arrowsmith had suggested that bronchoscopists and internists should work together more, and it is even more important that the endoscopists and the surgeons should work together, as their work runs more on the same lines. There are two differnt kinds of lung abscess, the bronchiectatic and the parenchymatous; the two may coexist or may run into each other, but there are characteristic cases of bronchial suppuration and also of parenchymatous lung abscesses. He stated that the commonest form of suppurative bronchiectasis is that resulting from the aspiration of foreign bodies, usually septic. A second type, parenchymatous abscesses, come from the blood stream and are pyemic in nature. The former may be treated as well as diagnosed by bronchoscopy supplementing the X-rays while the latter may exist for some time without the suspicion of its presence being aroused, although the X-ray examination will usually demonstrate an opacity. He quoted Lockwood, who has well said that lung abscess is a disease of symptoms and not of physical signs. A parenchymatous abscess should be treated through the chest wall if possible before a bronchial communication has been established. Then each cough or strain will tend to empty the cavity outwardly and bring its walls into contact for healing. When a bronchial connection has become established, how-

ever, air escapes through the abscess and out of the wound with far less tendency to obliteration of the infected space. Dr. Lilienthal said that the surgical problem in the treatment of abscesses not connecting with the bronchi is therefore much simpler than when a bronchial opening is present. Unfortunately the diagnosis of parenchymatous abscess is rarely made early. Another division of abscess is into putrid and nonputrid, the exact condition depending upon the organisms present. Continuing, the speaker said that the bronchoscope is a most important adjunct to the surgeon. That he had always been and still was in favor of bronchoscopy before every surgical operation upon the lungs. When he had omitted this precaution he has usually regretted it. A case in point was that of a woman referred to him by an out-of-town physician. She had a cough. The doctor said her tonsils should be removed. This was done, and a few days later the cough became worse and there was mucopurulent discharge. She became ill and septic. Surely, here was a case in which there would be no need to trouble the patient with the added annoyance of a bronchoscopy. There was apparently an aspiration bronchiectasis following a tonsillectomy. Dr. Lilienthal operated, intending to make a chest collapse because most of the left lung was involved in the suppurative process. The patient died and at the necropsy the diagnosis was absolutely confirmed so far as the character of the bronchiectasis was concerned, but a piece of bone as large as a human index terminal phalanx was found in one of the bronchi. It must have been there a long time for it had a calcified coating. Dr. Yankauer suggested that this woman had probably aspirated the bone long before her tonsils had been removed and it was the foreign body and not the tonsils which was the cause of her cough. Dr. Lilienthal thought it quite possible that the edema and suppuration in this case might have prevented the bronchoscopist from finding the bone but he would have at least been saved the chagrin of having omitted an important part of the examination.

The bronchoscope, he considered of great value in the diagnosis of pulmonary tumors. If these are to be safely treated by surgery early resection is necessary, whereas the surgeon now rarely sees these patients until the development of secondary suppuration has made lung resection unsafe. He stated that some day we shall operate upon these cases early because of the diagnosis by endoscopy combined with radiography.

The speaker said that bilateral lung suppuration had been thought to forbid surgery. This was, however, by no means the fact. On the contrary, it made surgery much more imperative than if the disease were unilateral. He had operated in several of these bilateral cases with good results. All these patients should be examined first by ordinary clinical methods, then by X-rays and finally, but invariably, by bronchoscopy.

In taking the history the story of surgical operation whether upon the air passages or upon any other part of the body should be carefully noted.

As to treatment, there was hardly time to take this up fully at present. He said that in the aspiration abscesses, especially in the early ones, artificial pneumothorax should be tested before operative surgery was invoked; that postural treatment also may bring about relief. Even spontaneous cure had been observed. Rapidly progressing putrid abscesses should be treated by early operation.

DR. DOUGLAS QUICK: I can add very little except in relation to malignant disease of the esophagus, and in that can only indorse what Dr. Forbes has said. With all due respect to our X-ray friends, we ought not to accept their diagnosis as final. Direct esophageal examination is most important. Differential diagnosis between cardiospasm and new growth can be settled promptly and believe with greater accuracy. Many kinds of external pressure upon the esophagus which may present an X-ray picture resembling either spasm or new growth can be cleared up in this way. I have had a number of examples of mediastinal nodes infiltrating the esophageal wall and presenting the picture very much like a true esophageal carcinoma.

New growths at the lower end of the esophagus are often primary gastric corcinomas high up along the lesser curvature, which obstruct the lower opening, thus producnig symptoms which bring the patient in with a diagnosis, usually confirmed by X-ray plate, of esophageal new growth. Here direct examination and biopsy will settle the problem.

As far as treatment of esophageal carcinoma is concerned, there is very little to be said. Early gastrostomy is of first importance and should be done as soon as the diagnosis is made. It is questioaable just how much benefit is conferred by the use of radium and X-rays or both. This work is largely experimental at the present time and while we hope that it may be of value, I doubt if anything conclusive has been performed as yet.

DR. LILIENTHAL said he could only call attention to the fact that Dr. Torek's famous patient was still alive, twelve years after operation, now about 75 years of age, and that Dr. Eggers had been fortunate enough to repeat that operation in a man in his thirties. His own patient, who was operated upon without gastrostomy and without entering the pleura, died a year and four months later of recurrence. That shows that one can do something in these cases. He has operated upon ten or twelve other patients by the same method, through the posterior mediastinum without entering the pleural cavity, and in only one case had he found the esophagus movable and alone involved so that it could be pulled away from the surrounding tissues; in the other cases the second stage could not be done because the disease had gone too far into surrounding organs. If we could get the cases earlier we could do better.

DR. LE WALD: I did not expect to discuss this subject but it is very interesting indeed, and I am in complete agreement with all of Dr. Manges' statements. I hope the members of this society will be able to make use of the various distinctive Roentgen appearances due to the aspiration of a foreign body. They are puzzling at first but are perfectly clear after one gives careful consideration to the mechanism which produces the changes in the lungs. We owe a debt of gratitude to Dr. Manges for his very careful analysis of the subject and his splendid illustrations.

THE AMERICAN BOARD OF OTOLARYNGOLOGY.

The American Board of Otolaryngology will hold its first examination during the Meeting of the American Medical Association in Atlantic City, May 25 to 28.

According to the rules of the Board, applicants are divided into three classes.

Class I. Those who have practiced Otolaryngology ten years or more.

Class II. Those who have practiced Otolaryngology five years and less than ten years.

Class III. Those who have practiced Otolaryngology less than five years.

The type of examination is different for each class.

The Secretary, Dr. H. W. Loeb, announces that thus far over three hundred applications have been made.